TELEPHONY

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Responsibility for Loss of Toll

By MISS GERALDINE CLEAVER

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WHAT CAUSED LOSS of toll business, in addition to depression? Indifference and carelessness in completion of calls, misquoted rates, discourtesy and slowness in giving information

DURING the past few years every business has suffered financially, and the telephone business was no exception. To a certain extent many business concerns were partly to blame for their losses and the telephone business was no exception in this respect, either, particularly in the loss of toll business.

The depression was not entirely to blame for the decline in toll. True, people were economizing in every way possible and were not placing long distance calls unless they just had to. However, the toll business has suffered—like many other lines of business—because of indifferent, inefficient or discourteous employes. In many cases the loss of business has been from the lack of employes.

Many a sale is lost in a store because of an indifferent clerk; many a business deal has been lost because of an inefficient employe. Long distance calls have been canceled for the same reason.

While in a store not long ago I asked the clerk, as he was wrapping up my purchase, if they had a certain article. "Why, I don't know," was the clerk's reply as he went on wrapping up the package without making any effort then, or later, to ask or see if they had the article in stock.

I did not ask him again. Instead I purchased the article at a store where it was not such an effort for the clerk to find out what they had in the store.

Numerous toll tickets are canceled—and sales lost—for the same reason. The operator is too indifferent to put forth an effort to serve the subscriber.

This is a day and age of keen competition. If the public cannot get what it wants in one place, it will go to another. The public demands efficiency and alertness; it objects to any delay in receiving service.

If we go into a store and find it impossible to be waited upon, we do not like it. We will, in all probability, go to another store where we are waited upon.

We are not concerned particularly as to the reason why the employes in the first store were not able to wait upon us. If the employer is not hiring enough help, it does not concern us; all we want is service. Service is what the public wants and asks for when placing a long distance call.

The public is not concerned as to whether the telephone company is employing enough operators or not. If the service is too slow, they will transact their business in some other manner.

Slow Telephone Service Irritates the Public

A subscriber will understand a "busy line" or a "busy circuit" report and, in most cases, will wait patiently. But they do not understand or care as to why the operator is slow in taking their call and attempting to complete it. Tickets have been cancelled and sales lost for this reason.

An operator can handle only so many calls. It is the duty of those in charge to see that there is sufficient help at all times. There will be unexpected rush periods, and the girls on duty will have to handle the work as best they can. When these periods become too frequent and still there is not enough help to handle the business, something is wrong and sales are bound to be lost. The goodwill of the public is lost also.

Perhaps some think that the public is forced to use the telephone—whether they like the service or not. In some instances they are. However, the long distance telephone service does have competition—the telegraph, the United States mails and the automobile.

There is no doubt that the telephone is far better and faster than these, providing the telephone company employs competent help. Otherwise it is neither better nor faster.

A few days ago a woman came into our office to place a call to a town of about 1,500 inhabitants. She wanted to talk to a Mr. B. at the home of a Mr. C. She told us that Mr. C. lived in town but did not have a telephone. She also told us that he had recently moved into a house from an apartment house. She told us to send a messenger to the house for Mr. B. It was a sick call and very urgent.

The operator at the called station did not know Mr. C. (it is impossible for an operator to know every one even in a small town) but the tone of her voice was so indifferent and unconcerned.

The toll center operator asked her

if she could not send a messenger and she replied: "I would not know where to send one." We asked her if she could not find out from someone where the man lived (surely in a town of that size someone would know where this man lived; we are always able to obtain such information from an oil station or a grocery store) and she answered, "I don't know how I could."

A Listless Operator Creates Ill Will

These reports were given to our party. She could not understand why at least an effort was not being made to find out where to send the messenger. The toll center operator had the operator ring two places for her. At one place they knew Mr. C, knew where the apartment house was that he had recently lived in but did not know where he had moved to. This apartment house, however, did not have a telephone either.

This had all taken considerable time. At last the operator at the called station said she could send a 25-cent messenger to the apartment house to ask where Mr. C had moved, and then send another 25-cent messenger to Mr. C.

A train was due in ten minutes, which would reach this town in a few hours. Our party canceled the call and wrote a card, which she mailed on this train. The indifference of that operator lost the good will of that patron. If the operator made any effort to find out where to send the messenger, she never let us know it. The party placing the call was more than willing to pay for service. The public does not like to have to beg for what they are willing to pay.

Teamwork Necessary Between Toll Operators

Completing a call depends, a great many times, upon the combined efforts of at least three operators—namely, the operator who receives the call, the toll center operator and the operator at the terminating point. It takes all three of these to complete a call, but any one of them may be responsible for the call being canceled when it might have been completed.

I do not believe any operator would intentionally lose a sale for her company. However, we all have canceled tickets that we could have completed with a little more effort. Look over your canceled tickets for the past few months and see if you do not find some that you could have completed if you had worked a little harder on them. I have found a good many such tickets among our canceled tickets.

We must remember also that the effort we put forth—or fail to put forth—helps or hinders another operator from completing her calls.

One way in which a call may be canceled unnecessarily is by the operator failing to verify a name. Another is by the failure of the operator at the called station to recognize the similarity of the name called for, which she does not have listed, and one that she does have. For instance a call is received for John Bothwell. The operator replies: "We have nothing listed for John Bothwell" and fails to add "But we do have a John Rockwell."

In such a case the call is oftentimes canceled immediately and a sale lost. There is always a possibility that the name was Rockwell. Perhaps the calling party had thought the name was "Bothwell" or the operator, to whom he first gave the call, thought he said "Bothwell."

In either case she should have verified the spelling of the name before allowing him to cancel the call. The operator at the called station should have been on the alert and suggested the names sounding anywhere near like "Bothwell."

Oftentimes when we want to purchase something, we are not just sure what we want. We welcome suggestions and help from an efficient and courteous employe. A telephone subscriber also welcomes a little help now and then. Sometimes he is not just sure about his call; and unless the operators are willing to help him and make suggestions, the call is apt to be canceled. Sometimes we are a trifle too willing to cancel calls.

Here is a true story showing how calls are canceled from lack of effort on the part of the operator:

Calling party—"I want to talk to Wm. D—— at M——."

Operator (after passing ticket and receiving the report)—"Mr. D—— does not have a telephone."

Calling party—"Then I don't suppose there is any way in which I can get him?"

Operator—"No, I guess not."

Calling party—"All right. Just let it go then!"

This ticket was canceled without the operator putting forth any effort to complete the call. She should, of course, have suggested sending a messenger. There is always a chance that the man might have consented to send one. At least she could have made the effort to complete the call and make a sale.

Slow service, as I have already stated, will also cause a slump in toll business. For instance, when a subscriber calls in for the rates to a certain town he expects to receive those rates within a reasonable length of time. I know of one case in which a man waited three-quarters of an hour in a telephone booth for an operator to quote him the rates to a town in another state—he wanted the rates before placing a call.

This man finally left the booth without receiving the rates and sent a telegram. The operator was supposedly too busy to look up the rates and quote them. But that fact did not make any difference to this man.

The result was that the telephone company lost the good will and confidence of this man (and no doubt a call) and the telegraph company gained a customer.

Slow Service, Mistakes Cause Slump in Toll

Misquoted rates, overcharges and discourtesy will also cause a slump in the toll business—as well as in any other business. If rates are misquoted and overcharges are made too frequently the public is bound to lose confidence in the service.

I realize it is impossible for this vast system to be perfect, but it does seem as though we have allowed the depression to carry too much of the blame for the loss in toll business. It is time for us to look around and see if we are not to blame for some of it.

I have been quoting only the faults and leaving out the good points of toll operating. These deficiencies, however, need to be remedied for the good of the business. It does seem too bad to even mention these things when so many thousands of calls are completed daily, and in such an excellent manner.

I am not forgetting the calls that have gone clear across the continent in such a few short minutes. I am not forgetting the wonderfully efficient and courteous service on so many calls and the gratitude of the public in consequence. I am not forgetting the hours frequently spent in completing just one call.

Neither am I forgetting that a telephone operator's life is anything but a bed of roses. I am not forgetting that she has all types of people to deal with daily, and it is a strain on the nerves. No, I am not forgetting any of these things. Why should I? I am an operator myself.

However, I am trying to look at

telephone operating from the public's viewpoint. After all, it is the public that we serve. I realize all too well that the public is apt to forget the wonderfully fine service it has received.

The public wants efficient service all the time. We cannot sit back and rest on our past laurels. We must give efficient service all the time. Even though an individual has received excellent service, over a long period of time, he will forget it very easily if once he receives poor service.

Then, too, one poor operator can undo all of the good service performed by the other operators. In any business, one poor employe can do more harm than all of the good performed by the efficient employes. A poor employe will lose business for a company regardless of the excellent work done by others.

Whether we in our own offices have many or few long distance calls a day, let us aim to not cancel any of them until we are sure that every effort has been made to complete them. Let us gain and keep the good will of the public. Let us deserve their confidence and let us be careful not to lose a sale for our company. Furthermore, let us be careful not to cause another operator to lose a sale.

The Operators' Corner

By MRS. MAYME WORKMAN
Traffic Supervisor, The Illinois Telephone Association, Springfield, Ill.

BIRTHDAYS of our two best beloved Presidents celebrated in February —George Washington and Abraham Lincoln. Series No. 181

GEORGE WASHINGTON and Abraham Lincoln, two of the greatest men our country has ever known—"The Father of Our Country" and "The Great Emancipator"—were born in the month of February.

The lives of some great men occasionally remind one of a kaleidoscope made up of many loose pieces. A cynic once said that we go through life with only one true friend, and that person is his or her mother. This certainly was not the case of George Washington. He possessed his mother's deep affection, and also had the devotion of the majority who crossed his pathway. As he ascended step by step until he reached the pinnacle of fame, his old friends, even those of boyhood's day, stood shoulder to shoulder with him.

Born on his father's plantation, our first President grew up near Fredericksburg, Va., and later at Mount Vernon, the plantation of his half-brother, Lawrence. There he studied mathematics, became a surveyor, and later an officer in the Virginia militia. He served under Braddock against the French and Indians and attained military fame which brought about his selection (June, 1775) by the Continental Congress as commander-in-chief of the revolutionary army.

After the war was won he sought to retire, but Virginia sent him to the Constitutional Convention, of which he was president, and he was unanimously chosen President of the United States under the new constitution. He was re-elected without opposition in 1792, and refused a third term in 1796.

The whole organization problem of the new nation confronted him as President. He kept Thomas Jefferson and Alexander Hamilton as his secretaries of state and treasury, although they disagreed on political principles, and had constant clashes about the building of a financial system, an army, postal and other services. European relations, federal court problems and the like were often solved peaceably only because all factions respected Washington as wise, just and fair.

Washington City was founded but not occupied by the government until Adams' presidency, Philadelphia being the capital during most of George Washington's two terms. He retired to Mount Vernon, but was recalled to Philadelphia in 1798 when war with France was expected, and devoted some time to reorganizing the army. He died December 14, 1799, of a cold contracted while riding about his estates, after less than two days' illness. Of him it was said he was "First in war, first in peace and first in the hearts of his countrymen."

Abraham Lincoln was our 16th President. He was born February 12, 1809, in a log cabin in Hardin County, Kentucky. He was self-educated, a farmer, ferryman, storekeeper and lawyer. This tall, vigorous, simple Westerner, who came to the White House in the nation's crisis of 1861, had served six years as a state legislator and two years in congress, but his fame rested largely on his debates with Stephen A. Douglas in 1858, where he sounded the keynote of the new Republicanism.

In his inaugural address, he declared that "The union of these states is perpetual." For a month, while preparing for war, he also pursued every effort at compromise. Through four years he stood against all criticism, through disaster that preceded victory, firm for union.

Critics assailed him in the campaign of 1864, declaring the war a failure. He stood firm and won. He chose and encouraged generals, went personally under fire, sponsored the National Bank Act when the nation's finances tottered, called for a draft when man-power failed, and was kind and gentle as a child to those who suffered for the cause.

Abraham Lincoln died from an assassin's bullet, April 15, 1865. Stanton, his war secretary, watching the tired eyes close for the last time, remarked: "Now he belongs to the ages."

Many years have passed since these two great men have been laid to rest but they truly belong to the ages. Their memory will live on through all time, their ideals will continue to be an inspiration to all generations to come.

Questions from Illinois Operators

1. On a MX call to a tributary, the distant operator receives a "BY" report. Should the distant operator leave "BY" call order with the tributary or the toll center?

2. If a station is calling a number and they are placing a call from the same number, how do you handle the call?

3. On a station-to-station collect call, does the call still remain station-to-station after the first attempt?

4. Should a tributary operator interfere on an incoming collect call where she thinks there is a possibility of the charge being disputed?

5. Are you supposed to hold collect calls?

For the answers to these traffic questions please turn to page 26.

Use Your Depreciation—Or Lose It

MUCH has been said and written recently about the subject of depreciation. It is from these voluminous written and verbal discussions that the telephone industry is beginning to realize how very important this subject is to the industry and to the public served.

In a recent article in TELEPHONY, E. C. Blomeyer discussed the effect upon the advancement and development of the art of the depreciation rate allowed telephone companies. In an article published in TELEPHONY of February 2, Alvin W. Sponagle described the method of determining telephone plant depreciation used by the Bureau of Internal Revenue.

Several weeks ago TELEPHONY published in full an application made by Illinois Valley Telephone Co., Streator, Ill., to the Illinois Commerce Commission asking for indefinite postponement of that commission's order on depreciation. This document contains many statements of interest to Independent telephone companies.

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ANOTHER IMPORTANT statement by an experienced telephone man on the subject of depreciation is contained in a talk made at recent district meetings of the Ohio Independent Telephone Association by W. C. Henry, president of that association.

Mr. Henry's remarks on the subject are of sufficient importance to all telephone companies to justify their consideration by companies in any state. Mr. Henry said in part:

"Recent decisions of the United States Supreme Court have made clear the fact that telephone companies are not going to be allowed to set aside out of annual earnings large sums for depreciation and then fail to expend the depreciation fund for rebuilding of their plants. You must either spend a reasonable portion of your annual depreciation or you will soon be forced to cut down the amount charged against income for this account.

Failure to expend the amount set aside for depreciation will gradually lower the physical condition of your property, increase your income taxes, and in the end jeopardize your rate structure.

New regulations of the Treasury Department are aimed at excessive or unused depreciation charges and reserves, and, henceforth, it is going to be necessary for you to justify the depreciation deduction on your corporation income tax return."

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THE TELEPHONE company that expects to obtain the benefits of a depreciation reserve larger than the amount which is prima facie needed by that company to meet deterioration of plant, or that expects to maintain charges to its operating expenses for depreciation for purposes other than the repair of plant, must either make constant use of its reserve or must have a well-defined plan for the future use of the reserve.

This is brought out clearly, with respect to income taxes, in Mr. Sponagle's article on depreciation accounting in TELEPHONY of February 2, wherein he cites the case of a telephone company that had accumulated a depreciation reserve at an unusually high rate for several years.

The company was able to sustain that rate only because it submitted a definite and specific replacement program for each of the years from 1935 to 1940, inclusive. It was able to show that its rate and reserve for depreciation were not excessive because it not only had definite needs, but also had definite plans for the use thereof.

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THE SAME PRINCIPLE applying to the rate of and reserve for depreciation with respect to income taxes applies also with respect to rates for telephone service.

It can be assumed, we think, that the rates for service charged by any telephone company possessing a depreciation reserve that might be considered excessive are in jeopardy unless that company is either now using that reserve by making replacements of plant or has a definite plan for its use within a reasonable time in the future.

Mr. Henry also said in his remarks, and truly, that prices of telephone equipment and construction material have already risen materially and that it is a safe prediction that they will rise still higher. It is a reasonable assumption that money spent now for replacement of plant will buy more plant and probably also more labor than the same money will buy in the future.

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SOME TELEPHONE managers may look upon this question of depreciation as principally one of accounting. It is, however, no more a matter of mere accounting than any other question of management.

It is time that the managers of telephone companies awoke to the dangers inherent in their situation if they have a large depreciation reserve and are not using it or are not making definite plans to use it. As Mr. Henry so aptly says, failure to expend the amount reserved will gradually lower the physical condition of the property, increase income taxes and, in the end, jeopardize the rate structure. The amount of depreciation to which you are entitled will be gauged largely in the future by the amount you actually use. The moral is plain—use your depreciation, or lose it.

The Magnetic Circuit and Inductance

By ARTHUR L. ALBERT

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SIXTH ARTICLE in series on Fundamental Principles of Electricity, which takes up the study of magnets, magnetic phenomena and discussion of inductance and inductive effects

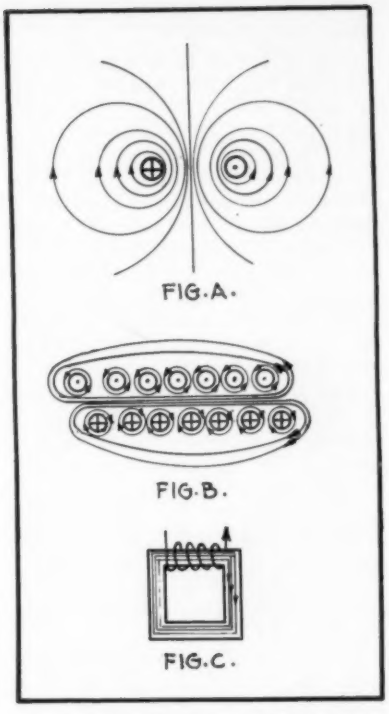

Fig. 2. Magnetic Lines of Force Around Wires and in Electromagnets.

THERE are three fundamental constants of electric circuits. These are *resistance, inductance, and capacitance.* Resistance has been considered in the preceding articles. Inductance will be discussed in this one. Before the theory of inductance and inductive effects can be presented, however, it is necessary to study magnets and magnetic phenomena.

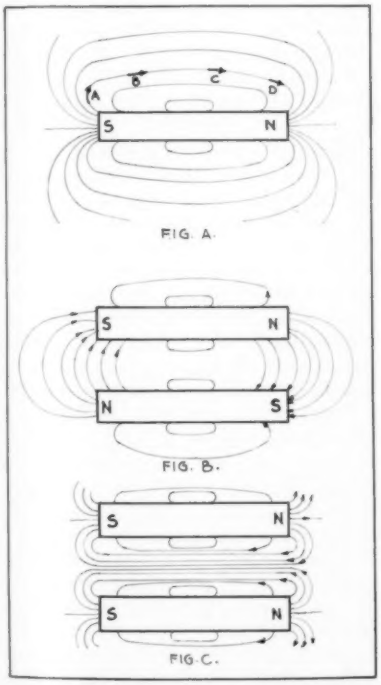

Fig. 1. Direction of Magnetic Lines of Force; Unlike Magnetic Poles Attract and Like Poles Repel.

Permanent Magnets: It is well known that a piece of steel can be magnetized, and that when so treated it will readily attract (or repel) other magnets, or bits of iron. Furthermore, it is well known that the needle of a compass will point in the direction of a magnetic field. The needle of a compass points toward the north pole of the earth, because it is in the magnetic field of the earth. This field extends from the north to the south pole.

Suppose that a small compass is used to explore the region about a permanent magnet by placing the compass at points *A, B, C,* and *D* of Fig. 1-A. The needle will, at each position, point in the directions indicated. A force must, accordingly, be acting on the needle, and a *magnetic line of force* is, therefore, said to be along the line passing through the points *A, B, C,* and *D.*

Similarly, the compass needle would point in definite directions if placed at other points, and hence other magnetic lines are pictured as shown. These lines of force can be shown by dusting iron filing on a piece of paper placed over a magnet. As the arrow heads indicate, Fig. 1-B, the lines for convenience are considered to pass *from the north pole to the south pole.*

A magnetic material such as iron or steel offers a better path to magnetic lines of force than does air, and it is for this reason that a magnet draws to itself a bit of iron. Thus, if two permanent magnets are laid parallel, as in Fig. 1-B, and if *opposite* poles are adjacent, the two magnets will be *pulled together,* because the lines of force are in the *same* directions and hence combine in passing through the steel magnets.

If, however, the two magnets are laid parallel but with *similar* poles adjacent as in Fig. 1-C, the two magnets will *not* be pulled together, but will be *forced apart.* The lines of force at each point are in the *same* direction, and the magnets *repel* each other. Thus, one important law of magnetism is: *Unlike magnetic poles attract, and like poles repel.*

Electromagnets: It is also well known that a coil of wire which carries a current of electricity will exhibit forces as does a magnet; for instance, it will attract the iron armature of a switchboard relay.

When a current of electricity passes *through* a wire, magnetic lines of force exist *around* the wire as shown by Fig. 2-A. If the current is flowing *in* (as the cross representing the tail of an arrow shows), the lines will be in the direction indicated. If the current is flowing *out* (as the dot representing the point of an arrow

shows), the lines of force will be in the *opposite* direction.

Now, if a wire carrying a current is coiled, the wires will all combine to send lines of force through the center of the coil as indicated in Fig. 2-B. To better illustrate the theory, a cross section of the coil is shown. Although in most apparatus the wires would be wound close together to prevent *magnetic leakage* between turns—that is, so almost all the lines would pass *through the center*—the turns have been spaced to show how the lines oppose each other and cancel out between turns.

The Magnetic Circuit: In order to obtain a better mental picture of magnetic phenomena, it is well to consider that magnetic lines of force *flow* through a magnetic circuit, just as it is thought that a current of electricity *flows* through a wire (although we cannot *see* the current). Thus, in Fig. 2-B the lines are "flowing" through an air path, and hence the *magnetic circuit* is air.

As was previously mentioned, however, magnetic lines of force had rather flow through a magnetic material, such as iron or steel, than through air, because these metals offer a better path. This is similar to the fact that a current of electricity will more readily pass through a copper wire than through one made of some high-resistance material such as German silver.

Therefore, if a soft-iron core is placed in the electromagnet of Fig. 2-B, it will be found that almost all the *lines flow through the iron* as Fig. 2-C indicates, and that with the same current they are greatly increased in number over those flowing through the air path.

It is now possible to state other fundamental laws of the magnetic circuit:

First, when a coil of wire carries a current of electricity, a magnetic "voltage" or *magnetomotive force* is produced. *Second*, this magnetomotive force is proportional to the *number of turns* and to the *magnitude of the current*. *Third*, this magnetomotive force *forces* the magnetic lines *through* the magnetic circuit.

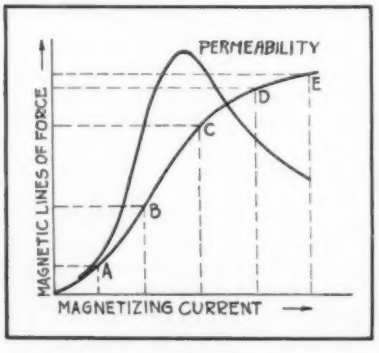

Fig. 3. Flow of Magnetizing Current and Lines of Force. A Permeability Curve.

Fourth, the material of the magnetic circuit offers an opposition or *reluctance* to the flow of these lines. Just as for the resistance of a wire, this reluctance is determined by the material, and is *directly* proportional to the *length* of the path, and *inversely* proportional to the *cross-section area*. These relations can be stated:

Lines of force = magnetomotive force/reluctance ..... (1)

The similarity of this relation to Ohm's law is evident.

Magnetization Curves: It has been stated that the magnetomotive force is determined by the current and the number of turns. Suppose that a coil on an iron core such as Fig. 2-B is available, that the current is increased in definite steps, and that the flux produced at each point is measured.

Assuming that the iron is demagnetized, increasing the current to point *A* of Fig. 3 will send lines of force corresponding to point *A* through the coil. Increasing the current to point *B* will cause a corresponding flux *B* to flow, and so on for the entire curve. It is at once evident that definite *increases of current do not cause corresponding increases of magnetic lines of force*. It will be recalled that for direct-current flow, however, doubling the voltage on a circuit of given resistance will double the current.

There is, therefore, a difference between the flow of current and the flow of magnetic lines of force or *flux*. This difference lies in the fact that although direct-current *resistance* is constant, and does not (under ordinary conditions) depend on the magnitude of the current, the opposition to the flow of lines of force or *reluctance is not constant, but is different for each value of the lines of force or flux*.

The fact that reluctance is not constant as is resistance makes the numerical solution of magnetic circuits somewhat involved. Such solutions will not be presented here, but will be found in most text books on electrical engineering.

In Fig. 3 is also shown a *permeability curve*. Such a curve is plotted from the ratio of the lines of force per square centimeter a given magnetizing force (magnetomotive force per unit length of path) produces when the magnetic substance is some magnetic material such as iron, divided by the lines of force the same magnetizing force produces when the magnetic path is air. Permeability is, then, the flux-conducting ability of a material compared to that of air.

Answers to Problems of Fifth Article

Here are the answers to problems concerning Fundamental Principles of Electricity given in the fifth article of this series, entitled "Sources of Direct-Current Energy in Telephone Systems," published in TELEPHONY of February 2:

13. 0.637 volt. Copper is positive.

14. 7.5 ampere. 5.625 volts. 42.2 watts.

15. 93.7 per cent.

16. 1.35 ohms.

17. 6.5 volts. 5 watts. 60 watts.

Magnetic Materials: The permeability or comparative flux-conducting ability of iron may be in the vicinity of 7,000. That is, the same magnetomotive force (or same number of *amperes* through the same number of *turns*) may produce 7,000 times as many lines of force in iron as in air. Thus, where intense magnetic fields are desired, the advantage of an iron path is evident. A small air gap may offer more opposition to the lines of force than the rest of the magnetic circuit.

Magnetic materials which are far superior to iron have been developed by communication engineers. Thus, permalloy, an alloy of iron and nickel which is carefully heat-treated, may show a permeability of *90,000 or more!* Furthermore, this high permeability occurs at low values of magnetizing force; that is, with weak currents. This property especially adapts permalloy for use in communication circuits where the currents are small.

Permalloy is extensively used for the magnetic circuits of relays, transformers, loading coils, and in many other ways. Perminvar is another interesting magnetic material. The permeability of this material rises to about 500 and remains constant at this value over a wide range of magnetizing forces; that is, the permeability remains constant over a wide range of current values.

Hysteresis: Although alternating

current has not yet been considered in this series of articles, an alternating-current phenomenon occurs in magnetic materials which should be discussed here. An alternating current flows in one direction and then reverses and flows in the other direction. The magnetic lines of force are caused to flow by the current, and hence these lines of force build up in one direction, reverse, and flow in the opposite direction, following quite closely the current changes.

A certain amount of electrical energy is required to change the magnetic field in an iron core and make it follow the current changes. This

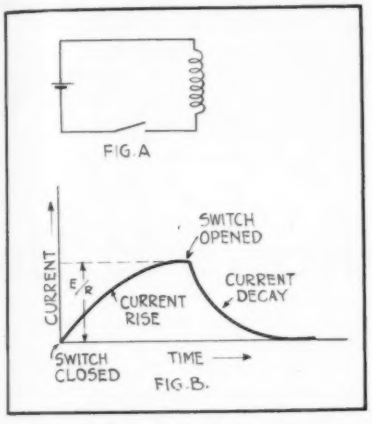

Fig. 4. Circuit to Illustrate Self-Inductance and Curve Showing Change in Current.

energy comes from the electric circuit composed of the coil producing the magnetization, and is dissipated in the form of heat, raising the temperature of the core. This energy loss is called a *hysteresis loss.*

Although this explanation is given for a rapidly-changing alternating current, the same effect occurs for direct current. Whenever flux is established in a magnetic material, energy is required to establish it. When the field dies out, energy is given back to the electric circuit.

The difference between that taken to establish the field and that returned to the circuit is the *hysteresis loss.* The hysteresis loss of permalloy and especially of perminvar is very much lower than of iron. In fact, perminvar has such desirable properties that it has been selected to load the proposed transatlantic telephone cable.

Induced Voltages: Another fundamental law of electromagnetism is as follows: *Whenever there is a change made in the magnetic lines of force linking a circuit, an electromotive force is induced in that circuit; and this electromotive force or voltage will be in such a direction as to tend to oppose the change.* This is Lenz's law. Thus, again consider Fig. 2-B. Here the lines of force are actually *linked with* the turns of wire.

When the current is increased so that the lines of force increase, the number of linkages is changed, and a voltage is induced in the coil. Similarly, when the switch is opened and the current dies out, the lines of force also die out, and in so doing change the number of linkages and again induce a voltage in the coil.

The magnitude of the induced electromotive force depends on the *rate of change of linkages,* or the *total number of turns of wire cut per second.* It, therefore, depends on the *total number of lines of force which change, the number of turns cut, and the time in seconds required for the lines of force to change.* Expressed as an equation, the average voltage is:

$$E_{av} = \frac{\text{lines of force} \times \text{number of turns cut}}{10^8 \times \text{time}} = \frac{\Phi N}{10^8 t} \quad (2)$$

The factor 10^8 is to give the voltage in volts.

Eddy Currents: Since a voltage is induced in any conductor in a changing magnetic field, it follows that a voltage is induced *in the iron magnetic circuit* of Fig. 2-C (in addition to that induced in the coil). The iron magnetic path offers a closed electric circuit, or current path, and hence electric currents, known as *eddy currents,* flow within this iron core.

These currents cause I^2R losses just as do any other currents, and these losses heat the core and dissipate energy which is taken from the electric circuit magnetizing the core.

To reduce these currents and hence the energy loss, cores are sometimes laminated to break up the current paths in the core. In early telephone coils the magnetic circuits were composed of bundles of iron wires to reduce these eddy currents. In the cores used at present, compressed, *powdered* iron or permalloy is used.

Eddy currents are also induced in the cases of magnetic devices, and in metal shields around coils, and in the metal frames and other mechanical supports. These effects are especially important at very high frequencies, such as is used in radio transmision.

Self-Inductance: Suppose that a circuit is arranged as in Fig. 4-A, and that the switch is suddenly closed. The current will not immediately rise to the value of E/R as Ohm's law predicts. Instead, the current increases along the curve of Fig. 4-B, finally reaching the value E/R.

As the current increases, the lines of force increase and a voltage is induced in the coil. This voltage opposes the impressed voltage and attempts to keep the current from being established. There must, therefore, be some property other than resistance in the coil, and this property is the *self-inductance* of the coil.

The self-inductance of a circuit may be defined as *that property of an electric circuit by virtue of which an opposing or back voltage is induced in the circuit whenever a change is made in the current flowing in that circuit.*

Now, if the switch of Fig. 4-A is suddenly opened, the current will not immediately fall to zero, but will die out according to the curve of Fig. 4-B. As the current dies out, the lines of force cut the coil, inducing a voltage which tends to keep the current flowing. These actions are in accordance with Lenz's law.

Inductive effects are of most importance in alternating-current circuits where the current is rapidly changing. Thus, a given alternating voltage will cause a large current to flow through a long straight wire, but if the same wire is wound into a coil, the inductance will reduce the current flow to a much smaller value.

Inductance is a property of a coil which opposes an alternating-current flow, and this opposition is in evidence by an induced voltage. A circuit has an inductance of *one henry* when a rate of change of *one ampere per second* induces a back voltage of *one volt.*

Mutual Inductance: Suppose that *two* coils are wound on the continuous

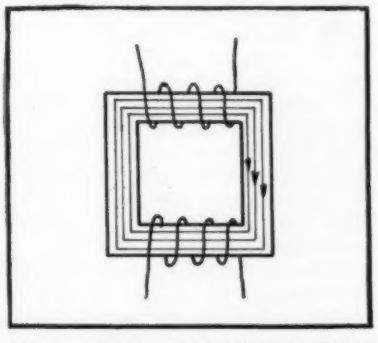

Fig. 5. Arrangement to Illustrate Mutual Inductance.

iron core of Fig. 5. If a current is caused to flow through one coil by closing the switch, this current will cause lines of force to flow through the core. This establishing of lines of force changes the flux linking *both* coils. A voltage will, therefore, be induced in the second coil.

When two coils are not directly con-

nected but are so related that a *change of current* in one coil *induces a voltage* in the other, the coils are said to possess the property of *mutual inductance*. When a rate of change of *one ampere per second* in the first coil induces a voltage of *one volt* in the second, the mutual inductance is *one henry*.

The two coils on the iron core of Fig. 5 constitute a *transformer*, or *repeating coil* as it is often called in telephone work. Thus, if a source of alternating voltage is connected to one winding called the *primary*, a voltage will be induced in the other coil called the *secondary*. The ratio of the magnitudes of the two voltages will depend on the ratio of the primary and secondary turns.

Summary: Lines of magnetic force exist about permanent magnets. These lines of force cause unlike magnetic poles to attract and like magnetic poles to repel. These lines also cause permanent magnets to attract bits of iron or steel, since the lines find less opposition in metal than air.

When a coil of wire carries a current, lines of force are set up about the coil. Adding an iron core to the coil greatly increases the lines of force. Alloys, such as permalloy and perminvar, are also used for magnetic circuits.

The current of electricity passing through the turns sets up a magnetomotive force or a magnetic pressure which *forces* the flux through the magnetic circuit. The ratio of the flux-conducting ability of a substance to that of air is called the *permeability*. This may be 90,000 or more for permalloy.

Hysteresis and eddy-current losses occur in magnetic materials which are cut by an alternating magnetic field. Eddy-current losses also occur in nonmagnetic shields such as are placed about coils.

Lenz's law states that whenever a *change is made* in the flux linking a circuit, *a voltage is induced* which tends to oppose this change.

The self-inductance of a circuit is measured in henrys and is that *property* by virtue of which a *change* in *the current* flowing in the circuit *causes a back voltage to be induced*.

The mutual inductance of two circuits is also measured in henrys, and is the *property* of two circuits (not in direct contact) by virtue of which a *change of current* in one *causes a voltage to be induced in the other*.

NOTE: No attempt has here been made to present the numerical relations existing. No problems are, therefore, included.

Massachusetts Telephone Bills

HOUSE BILL providing for elimination of hand set rental charge meets with vigorous opposition by counsel for New England Bell at recent hearing before Massachusetts house committee. Proposed installation of meters for dial telephones also provokes storm of protest. Another bitterly contested bill provides for commission regulation of advertising

A PROTRACTED session of the Massachusetts legislative committee on power and light took place at Boston on February 6 over several bills designed to quash the New England Telephone & Telegraph Co.'s rental charge for hand set telephones and to provide for the installation of service meters at subscribers' stations. They were house bill 1305 (prohibiting extra charges for hand sets); house bill 1153 (requiring the company to furnish call registers on request at dial stations); and house bill 1447 (a mandatory act applying to telephones generally).

Representative E. P. Bacigalupo, of Boston, contended that the present charge of 15 cents per month for hand sets should be eliminated. He declared that "we are living in an age of style, and telephone sets should be available on modern lines without extra charge." There is no more reason, he said, for the hand set charge than for increasing the rental of an apartment because a modern sink replaces an old-fashioned stone outfit.

Representative G. F. Kilgour, of Boston, favored the bill, asking when the hand set would be paid for through the present rental.

Hand Set Charge Defended by Company

Geo. R. Grant, counsel for the New England company, defended the hand set charge. He pointed out that it had been cut voluntarily by the company from 25 to 15 cents per month and that if the charge were abolished, the company would lose $633,693 in annual revenue in New England and $455,919 in Massachusetts. There are now 352,052 hand sets in use in the entire territory and 252,177 in Massachusetts, according to the witness. More than 25 per cent of the subscribers use hand sets.

These sets partake of luxury, said Mr. Grant. It costs more to operate them than the desk sets, and the 70 odd percentage of subscribers who use desk sets should not be required to carry the extra cost of the hand set telephones. The first cost of the hand set is $11.23 against $5 for the desk set. Repairs are somewhat greater with the hand sets. The company estimates that the total annual cost of hand sets—including interest, depreciation, repairs and other charges—is $1.90, or 10 cents more than the company receives.

Mr. Grant called attention to the decision rendered last summer by the Massachusetts Department of Public Utilities in the company's rate case (sustaining the company), which stated, among other things, that the company was in no position to further cut the hand set price. The situation has not improved since, as in the last half of 1934 the company lost 19,000 stations after gaining well in the first half.

The company now has $4,750,000 invested in desk sets, Mr. Grant said. If free hand sets were offered, the overnight demand would be enormous—requiring a possible fresh outlay of $8,500,000 and adding $1,200,000 a year to the costs of a company which just barely earned a 6 per cent dividend in 1934. The continued employment of 20,000 men and women and the dependability of the service require adequate revenues; and if the dividend should fall below 6 per cent, the company's bonds would cease to be legal investments for Massachusetts savings banks. The company's stock touched par on one day only last year.

(*Concluded on page* 21)

(*Concluded from page* 16)

A. L. Jacobson, a Boston attorney, demanded meters at subscribers' stations on the ground that the metering equipment at exchanges was unavailable to the user of dial sets. He argued that the company was the final court of appeal in case of disagreement over the number and duration of calls on any line, and objected to this. The speaker asserted that "stock" questions were asked by supervisors in case of disputed bills on machine switched lines, such as:

(1) Do you keep a record of your calls? (2) How many people have access to your telephone? (3) Do you lock your telephone at night in your office to prevent its use by scrubwomen?

Vigorous Argument Over Meters

Mr. Jacobson classed the last point as remote in application and contended that checks of calls in the office shared by his associates did not match the company's figures. He was considerably disturbed over the alleged lack of warning at the expiration of the five-minute period allocated to each call on the message rate basis, except in pay station or slot type stations.

Edward J. Leary, of Boston, also supported the bill, but suggested that the subscriber be asked to pay a moderate sum for the use of a substation meter. It was pointed out that meters were available in non-dial areas at 50 cents per month.

Hyman Manevitch, of Boston, likewise urged the need of subscribers' meters.

Mr. Grant, counsel for the New England company, said that all these bills attack the lifeblood of the industry and, after referring to the law requiring the 6 per cent dividend as a touchstone of savings bank bond investment policy, said that any reduction in revenue which threatens dividends and wages should not be permitted. Said the witness, in part:

"We are the largest employers of labor in the state, and are unalterably opposed to any curtailment of either the wages of capital or the wages of labor. Boston has more telephone registers on subscribers' sets than any other city in the country and probably, in the world; but even this number totals only 357. In 1914 registers were made available at the behest of the legislature. After a year or so, 3,708 recorders were in use, and since then the number has steadily dwindled."

"In operating dial system lines no need for a subscriber's register exists," continued Mr. Grant. "We have 183,000 dial lines in a certain area, and 70 per cent of these are on measured service rates. No instrument exists that is capable of measuring calls on dial sets at the subscriber's station and, so far as I know, the manufacturers of telephone equipment have no idea of either designing or making such equipment. There is no material demand for its use."

An engineering study of the cost of providing such meters as the bills call for in Massachusetts revealed a total requirement of $10,500,000 on measured service lines alone. The cost of merely reading the meters would be $137,000 a year. Such devices would slow up the service, the witness asserted, as the subscriber would have to perform an additional act in using his service.

It might be necessary for the company to give up its present system of charging for overtime on calls. Additional operators would have to be hired to come in on the line and tell the subscriber when it was time to press a button and record an extension of the call period. The public would not tolerate such interference with service, Mr. Grant asserted.

Care to Insure Accuracy of Central Office Meters

The witness then described the care taken to insure accuracy of the message registers used at the central offices. He pointed out that there is no analogy between the use of gas and electric meters and telephone meters, as claimed by some of the speakers, since the former cannot be located anywhere else than at the premises of the user.

The law allows gas meters to deviate 2 per cent and electric meters 5 per cent from standard. Tests show that 0.2 per cent of the dial telephone lines have registers which under-record the calls.

Meters used at the central office are located on a frame disassociated from the operating room and near the dial apparatus. Tests are made by the "pen point" register, which is tied into the subscriber's circuit and records on a tape the beginning and ending of each call and shows on what line the call was made and how long it lasted.

In another room observing apparatus is connected to the line and it records the number called for and the time of usage. These two records are compared and an operator with a head set is also on the line, checking the tape with her own timing device. Thus three separate and independent service checks occur.

Mr. Grant said that it is almost invariably found that the results check 100 per cent, and that any deviation is against the company. "We are, therefore, warranted in being enthusiastic over our equipment," he said.

Inspectors of the Massachusetts commission make no general practice of checking the central office meters in the absence of complaints. The company admits that bookkeeping errors sometimes occur, but contends that the number is practically negligible. It holds that the forced installation of meters on subscribers' premises would mean the junking of about two million dollars' worth of central office equipment, and the rates would of necessity reflect the capital outlay.

Would Have Commission Regulate Telephone Advertising

Wyckliffe C. Marshall, sponsor of house bill 158, introduced by Representative J. A. Murray, of Boston, to place outlays for public utility advertising under the jurisdiction of the Massachusetts Department of Public Utilities, appeared before the committee on January 30 with the argument that telephone company advertising should likewise be included in this category. He declared that advertising is used to ward off rate reductions, to boost the sale of holding company stock and to influence public opinion in favor of public service corporations. Mr. Marshall said that the total outlay for public utility advertising in Massachusetts in 1934 was $593,563.

George R. Grant, counsel for the New England company, vigorously denied that newspaper policies are affected by the sums devoted to advertising by the communications company. He pointed out that the New England company spent only 0.3 per cent of its gross revenue in advertising, and asserted that the bill was thoroughly impracticable.

It requires that the utility shall determine its advertising outlay plans two months before the beginning of the fiscal year, or 14 months before its end, and then submit its proposed expenditures to the commission. Not a nickel could be spent until the board's approval had been obtained, regardless of the emergency.

"Since July, 1934," said Mr. Grant, "the New England company has lost 19,000 stations, and during the entire depression, 180,000 net. The company believes that newspaper advertising helps it to get back business greatly needed as well as to secure new patronage. Not only this, but many advertisements are inserted during acute conditions of weather when the company seeks a better understanding of its efforts to render service.

"Information about cut-overs to dial exchanges must be provided the general public at the proper time; popular consideration has to be sought at times of great stress; and the closing dates of telephone directories cannot be set far ahead of their occurrence. The company has service to sell and believes that unless its managerial powers are to be abandoned and turned over to others, no such bill should be written into the laws of the state."

Late News Developments From Washington, D. C.

Investigation Resolution Adopted by Senate

The resolution authorizing wide investigation of the American Telephone & Telegraph Co. and other telephone companies which handle interstate calls, by the Federal Communications Commission was adopted on February 12 by the Senate without a record vote.

Senator William H. King (Dem.) of Utah protested the expenditure, declaring there are "too many commissions placing a burden on the taxpayers."

The House committee on interstate commerce favorably reported a similar resolution on February 5. Action will undoubtedly be taken on it soon by the House.

Although applications for a hearing on the resolution had been made to both Senate and House committees by the United States Independent Telephone Association, the resolution was reported out by both committees without hearings being held.

The resolution in its original form (TELEPHONY of February 2) directs the FCC to investigate and report to Congress on practically all phases of the telephone industry, with respect to the American Telephone and Telegraph Co. and *all other* companies *engaged directly or indirectly in telephone communications in interstate commerce . . .*" Under this last clause practically every Independent telephone company is subject to the investigation.

The sum of $750,000 would be appropriated for the investigation, which is a record-breaker for initial lump-sum appropriations for such inquiries. The proposed inquiry would be as broad in scope as the recently-completed six-year investigation of power companies by the Federal Trade Commission. The details of wide scope of the investigation are given in the resolution as published in TELEPHONY of February 2.

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Proposed Association Ceases Activity

The party in Washington, D. C., who was sponsoring the "Independent Communications Association" and had circularized many of the Independent companies (TELEPHONY of February 9), has discontinued his efforts.

After sending out the letters, he learned that the United States Independent Telephone Association is actively representing the Independent companies in Washington. His only previous information regarding the telephone situation was obtained from parties in Washington having no connection with the field and unfamiliar with it.

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U. S. Senate Confirms Nominations to FCC

On February 7 the United States Senate confirmed the nominations of six members of the Federal Communications Commission. These are the members who have been serving since last July. They are:

Judge Eugene O. Sykes, of Mississippi, chairman, seven-year term.

Thaddeus H. Brown, of Ohio, six-year term; vice-chairman of the broadcasting division.

Paul A. Walker, of Oklahoma, five-year term; chairman of the telephone division.

Norman S. Case, of Rhode Island, four-year term; vice-chairman of the telephone division.

Dr. Irvin Stewart, of Texas, three-year term; chairman of the telegraph division.

George Henry Payne, of New York City, two-year term; vice-chairman of the telegraph division.

Anning S. Prall, of Staten Island, N. Y., has been appointed to take the place of Hampson Gary, chairman of the broadcasting division, who resigned January 3. Mr. Prall's nomination was confirmed by the Senate last month to fill out Mr. Gary's term of one year.

Mr. Prall is of Dutch descent. Staten Island was once Prall's Island, named after his ancestors. He was born there in 1870 and began his business career on the New York World and the New York Recorder.

Then he was employed in the mortgage loan department of the Staten Island Savings Bank. Later he became vice-president of Cosgrove & Co., which operated coal mines in Pennsylvania and elsewhere. Mr. Prall was thrice elected president of the board of education of New York City and was a commissioner of taxes and assessments in New York about 10 years ago.

In Congress 12 years, Mr. Prall served on the House committee on banking and currency.

Last March Mr. Prall was confirmed by the Senate for membership on the old Federal Radio Commission but he never served. He wanted to complete his term in the 73d Congress and did.

Meantime Congress created the Federal Communications Commission, replacing the Federal Radio Commission. There is an old law under which a federal legislator cannot serve, during a Congress of which he is a member, on a federal commission created by that Congress. And the 73d Congress ran on until January 3, 1935.

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FCC and Bell Interests in Independents

Press dispatches from Washington early this week state that sweeping inquiry into financial interests of the Bell System in 50 Independent telephone companies is planned by the Federal Communications Commission. It is stated that the FCC will seek to determine its jurisdiction over companies suspected of doing interstate business but which contend their traffic is wholly intrastate.

Of the large list selected for study, the newspaper dispatches state, only two have yet been picked for hearings, but for which dates have not yet been set. They are the Princeton (Ind.) Telephone Co. and the Intra State Telephone Co., of Galesburg, Ill.

These dispatches are evidently based upon the recent action of the commission in sending out questionnaires to the some 6,000 Independent companies, asking for information relative to exchange and toll facilities and ownership. Practically all the Independent companies claim exemption from jurisdiction of the FCC, due to their being unable to complete interstate toll calls with their own facilities.

The FCC has given no interpretation of the Communications Act of 1934, but competent attorneys have advised the United States Independent Telephone Association that its interpretation, as given to its member companies, undoubtedly would be upheld in the courts.

The FCC apparently is endeavoring to claim jurisdiction over many Independent companies in which the Bell company holds some preferred or common stock, or both, on the grounds that the Bell controls these companies. It is understood that the commission's decision (TELEPHONY of January 19) assuming entire jurisdiction over the Chillicothe Telephone Co., Chillicothe, Ohio, was based upon the supposition that the Bell controlled it because of own-

ership by it of some of the Chillicothe company's stock.

The decision was made without a hearing and was protested by the company and the United States Independent Telephone Association. It was then decided to reopen the case and allow the company opportunity to present the actual facts at a hearing.

Last week the FCC announced that on January 24 it had decided to hold hearings on its jurisdiction over the Intra State Telephone Co. of Galesburg, Ill., and the Princeton Telephone Co., Princeton, Ind.

As any company owned or controlled by the Bell would presumably come under the jurisdiction of the FCC, the commission may, as the newspaper reports state, be inquiring into Bell stock ownership as to control of various Independent companies as a means of obtaining jurisdiction over as many companies as possible.

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FCC Asks Control Over Foreign Circuits

The Federal Communications Commission on February 6 recommended to Congress an additional amendment to the Communications Act of 1934 to give it control over cable and radio circuits between the United States and foreign countries as a step to combat foreign monopolies. It asked legislation to prohibit the opening of new wire or radio communication systems between the United States and foreign countries unless the commission's permission is first obtained.

"Competition has its worst effects in the field of foreign communication," the commission told Congress. "Communications in most foreign countries are handled as a monopoly. Where the monopoly has two competing American companies offering to establish circuits, it can drive progressively harder bargains to the detriment of American interests.

"As existing contracts expire or are terminated, it will undoubtedly develop that those which replace them will be upon terms much more adverse to American interests.

"The proposed amendments would give the commission some degree of control over this situation."

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Telephones Excluded in Holding Company Bill

Drastic regulation of public utility holding companies is proposed in bills introduced in both branches of Congress by Chairmen Wheeler and Rayburn of the Senate and House interstate commerce committees on February 6. The measures provide for federal control over holding companies of operating companies in the gas and electric field.

That control of telephone holding companies is not contemplated is indicated by the title of the bill which states it is:

"A bill to provide for control in the public interest of public utility holding companies using the mails and the facilities of interstate commerce, to regulate the transmission and sale of electric energy and natural gas in interstate and foreign commerce, and for other purposes.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this act may be cited as the 'Public Utility Act of 1935.'"

While the telephone is considered as a public utility, telephone companies are definitely exempted from provisions of the bill under the definition:

"(5) 'public utility company' means an electric utility company and/or a gas utility company."

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FCC Hearing on Interlocking Directorates

On February 4 and 5 the Federal Communications Commission held a hearing on interlocking directorates. It had cited a number of men who serve as director for more than one communica-

A Drastic Price Reduction on All Gray Pay Station Equipment

effective March 1, 1935

We believe this reduction in price will be appreciated by all operating telephone companies, coming as it does at a time when companies are realizing more and more the revenue possibilities existing for them in pay station equipment.

A schedule of the latest prices will be furnished to any company upon request or your telephone jobber will be glad to quote you.

Plan now to install Gray Pay Stations in the public places of your territory. They will prove to be a wise investment.

GRAY TELEPHONE PAY STATIONS

GRAY TELEPHONE PAY STATION CO.
HARTFORD, CONN.

Order Direct or Through

AMERICAN AUTOMATIC ELECTRIC SALES CO., Chicago
KELLOGG SWITCHBOARD & SUPPLY CO., Chicago
GRAYBAR ELECTRIC CO., INC., New York, N. Y.
STROMBERG-CARLSON TELEPHONE MFG. CO., Rochester

Or any other telephone supply house

tions company, to show cause why they should be allowed to continue in such capacity.

The Mackay Radio Co. purchases its equipment from the Federal Telegraph Co., Sosthenes Behn, president of International Telephone & Telegraph Corp., the parent company, testified at the hearing on February 4.

Col. Behn described the holding company setup included in the I. T. & T. system. His holdings are entirely in the I. T. & T., he said. He seeks to continue to hold the posts of director of six I. T. & T. subsidiaries as well as his position as president of I. T. & T.

In answer to a question from Chairman Sykes of the FCC, Col. Behn declared that the holding company never attempted to operate in the stock market by purchasing or selling stocks of subsidiary companies with the idea of "moving the market."

Newcomb Carlton, chairman of the board and of the executive committee of Western Union Telegraph Co., described that company's relation to Mexican Telegraph Co., on which Mr. Carlton also seeks to serve as an official.

Edwin F. Carter, vice-president of the A. T. & T. Co., and a former president of the Ohio Bell Telephone Co., discussed his application to continue as a director of the Ohio Bell Telephone Co. and of the Cuban American Telephone & Telegraph Co. He was quizzed on the relationship of the Ohio Bell and the Cincinnati & Suburban Bell Telephone Co.

John W. Felton, secretary-treasurer, Western Telephone Corp., explained his application to be secretary and a director in subsidiary companies. There are three subsidiary companies that perhaps may be under the jurisdiction of the FCC—the Western Telephone Corp. of Kansas, the Western Telephone Corp. of Texas and the Western Telephone Corp. of Oklahoma.

Affiliated companies of the Bell System pay to the American Telephone & Telegraph Co. 5.88 per cent for loans made by the parent company to the subsidiaries, Walter S. Gifford, president of the A. T. & T., declared at the hearing on February 5. Mr. Gifford serves as a director and an official of American Telephone & Telegraph Co. and as director of the affiliated companies.

The depreciation reserve of the A. T. & T. Co. is held as a separate account, President Gifford said, and dividends are not declared from it, he asserted, in reply to a direct question from Commissioner Walker. At the present time the depreciation reserve includes approximately $200,000,000 in government securities. A part of the current dividend of the A. T. & T. Co., Mr. Gifford said, is out of surplus.

After pointing out, in answer to a question, that directors of the A. T. & T. own only a small amount of the total stock outstanding, he declared he held the view that it would be better if officers and directors of companies had no stock interest in them. If such were the case, he said, their actions would not be influenced by the effect they might have on the value of securities.

David Sarnoff, president of the Radio Corp. of America, told the commission on February 9 that if it objects to the same directors handling two subsidiaries, the Radio Corp. of America Communications and the Radio Marine Corp. will be merged with the parent corporation. The two concerns were formed in 1927 and 1929 taking over what then were departments of the parent company.

Mr. Sarnoff said that an objection by the commission to interlocking directorates would be met by returning them to the status of divisions. He added he thought this was undesirable, however, because as separate corporations the managing officers have an incentive to make a profitable showing which would not exist as divisions of another company.

Mr. Sarnoff and Lewis McConnach, secretary of RCAC and Radio Marine, appeared before the commission to defend their right to serve as officers and directors of the two companies.

Commission and Court News

Louisiana Rate Inquiry Continued to February 25

The telephone rate inquiry under way in Baton Rouge, La., by the Louisiana Public Service Commission was continued until February 25, at the request of Senator Huey P. Long, attorney for the commission, after the Southern Bell Telephone & Telegraph Co. had submitted testimony as to operation costs and returns at a brief hearing on January 24.

The telephone company has been required to show cause why it should not reduce its rates, and according to testimony given by W. E. Duncan, the company's chief accountant, and L. W. Hill, the company's appraisal engineer, a fair return cannot be made on its investment if forced to cut rates. Mr. Duncan testified that if taxes, which will be effective in 1935, had been applicable in 1934, the company's earnings would have been only 3.2 per cent. Mr. Hill declared that depreciation was about 4.5 per cent a year.

Senator Long will cross-examine the company witnesses at the continuance of the hearing, it was stated. Senator Long said that complaints of excessive charges for remote control wire service, made by nine state radio stations, will also be included in the extended inquiry.

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Wisconsin Bell's Handset Charge Ordered Reduced

The 25-cent monthly extra charge of the Wisconsin Telephone Co. for handset telephones, affecting 50,463 patrons, of which 23,433 are in Miwaukee, was ordered reduced to 8 cents, effective August 5, 1935, in an order issued by the Wisconsin Public Service Commission on February 7.

The reduction cannot go into effect before August 5, the commission explained, because the company has obtained three injunctions, preventing any decrease, the last of which expires August 5. Should the injunctions be vacated before that date, the reduction order would go into effect earlier.

The commission stated that so far as it knew, no other state has a lower charge than 15 cents. All additional charge for handset telephones may be abolished when the commission issues its permanent order in the statewide investigation of the company, it indicated.

The commission found that "the present additional monthly charge on handset telephones is unreasonable and excessive and unreasonably discriminatory and that for the purpose of the present order a recruing rate of 8 cents monthly is fair and reasonable."

In addition, all customers with handset telephones during the three years ending August 5, 1935, will get a refund of nearly $50,000 on the additional charge for handset service if the commission's three annual rate reduction orders are eventually sustained by the courts, because these orders reduced handset telephone as well as other exchange rates of the Wisconsin Telephone Co.

COMING CONVENTIONS

Iowa Independent Telephone Association, Hotel Fort Des Moines, Des Moines, February 26 and 27.

Wisconsin Locally Owned Telephone Group, Park Hotel, Madison, March 5.

Wisconsin State Telephone Association, Park Hotel, Madison, March 5, 6 and 7.

Oklahoma Utilities Association, Hotel Biltmore, Oklahoma City, March 12 and 13.

Texas Telephone Association, Baker Hotel, Dallas, March 25, 26 and 27.

Kansas Telephone Association, Hotel Kansan, Topeka, April 10 and 11.

Ohio Independent Telephone Association, Hotel Deshler-Wallick, Columbus, May 1 and 2 .

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 8 and 9.

Pennsylvania State Telephone & Traffic Association, Penn-Harris Hotel, Harrisburg, May 14 and 15.

It appears probable that handsets may be considered standard equipment in the not-far-distant future, said the commission's order, signed by Commissioners A. H. McDonald and Fred B. Hunt. It says, in part:

"From an economic viewpoint, the commission is interested in securing the lowest possible rates consistent with good service and fair treatment of utility investors.

"While we believe technical progress should not be withheld from customers by rate practices any more than by 'putting patents to sleep,' we recognize that low rates cannot be obtained if equipment changes are unduly stimulated so that plant investment and operating expenses increase without proportionately increasing the quality and value of the service. . . .

We also believe subscribers are entitled to improvements in telephone service promptly and without unreasonable expense. We expect that in the near future the extensive engineering and research organization of the Bell System should be able to reduce the cost of handsets so that subscribers can be given the convenience of this equipment without additional cost."

Reduction of the additional charge from 25 to 8 cents a month is "absolutely insufficient" to meet the additional costs of furnishing the instruments, according to W. R. McGovern, president of the Wisconsin Telephone Co. In a statement, Mr. McGovern indicated the telephone company will go into court if necessary to prevent the order from becoming effective.

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High Court Sustains Company at Tulsa, Okla.

Announcement was made January 26 that the United States Circuit Court of Appeals at Denver, Colo., had sustained a decision of Justice F. E. Kennamer of Tulsa, Okla., holding that the Southwestern Bell Telephone Co. had a right to operate in the city of Tulsa under both territorial and state laws, and that city charter provisions to regulate the telephone company were unconstitutional. The city had sued the company for $900,000 and asked the court to oust the company.

• • •

Oregon Commission Reaffirms Rate Cut

In an order issued January 28 by Commissioner C. M. Thomas, reaffirming his previous decision reducing the rates of the Pacific Telephone & Telegraph Co., he estimated that the order would save Oregon patrons of the company approximately $360,000 annually.

Following the original order the telephone company appealed to the circuit court for Multnomah county, where additional testimony was taken. This testimony was then certified back to the utility commissioner.

• • •

Maryland Rate Case Before U. S. Supreme Court

On February 4 the United States Supreme Court agreed to review the decision of the federal statutory court on Maryland telephone rates. The statutory court in Baltimore last June ruled that rate reductions ordered by the Maryland Public Service Commission, which would have cost the Chesapeake & Potomac Telephone Co. $1,200,000 a year, were confiscatory, and prohibited the commission from enforcing them. The commission appealed to the supreme court, which agreed to review the case.

The commission denied the rate reductions constituted confiscation of the company's property, holding that under the proposed new rates the company would get sufficient revenue.

The Chesapeake & Potomac Telephone Co. recently abandoned its appeal from a court decision in the District of Columbia, upholding a rate reduction ordered by the District of Columbia Public Utilities Commission and agreed to the reduction, which amounted to about 10 per cent in domestic rates.

In the Washington, D. C., case the

Cook XB is NOT radical in design. The design is based on thirty years of successful satisfactory experience with a steel corebox.

And like its predecessor, Cook "All-Steel" protected terminal, the XB terminal is living up to its reputation 100%.

So well has the XB served that a single telephone company in New York State has more than 12,000 installed.

For terminals of PROVEN MERIT specify COOK.

Cook Electric Co.

CHICAGO

company also refunded subscribers the amount they had paid in excess of the new rates during the two-year period the case had been before the courts.

• • •

Lower Hotel Rates In Mississippi Asked

A petition for reduction in telephone rates charged hotels in Mississippi, to put the rates on a level with those of neighboring states, was filed with the Mississippi Railroad Commission February 6, as it reopened the hearing of its citation against all telephone companies operating in the state demanding rate reductions.

Judge Garland Lyell, attorney for the Mississippi Hotel Owners' Association, presented the petition, asking that present hotel rates be cut one-third. At present, he said, hotels are charged 50 cents per room where the hotel owns its own wires, and 75 cents if the telephone company owns them.

• • •

Ouster Recommended of Company at Lebanon, Mo.

Ouster of the Missouri Standard Telephone Co. from Lebanon, Mo., was recommended to the Missouri Supreme Court January 23 by J. R. Baker, of Fulton, a special commissioner.

The recommendations were made in connection with the quo warranto proceedings filed against the company by Attorney General Roy McKittrick, after the Lebanon board of aldermen had refused to renew the company's franchise. Since termination of the company's franchise, December 11, 1932, the alderman granted a franchise to a local group to operate a telephone system there.

Attorneys for the company, in arguments filed with the court, contend the telephone company is authorized to operate in the Leclede county city under a permit issued by the Missouri Public Service Commission.

At the time its franchise expired, the Missouri Standard company was paying the city of Lebanon $150 a year for the use of its streets and alleys. Recently the city requested the company to pay an annual charge of $2000.

The new company, the findings showed, had been asked to pay the city $325 annually for the use of its thoroughfares.

Mr. Baker's rcommendations were based on testimony taken at a hearing in Lebanon, December 6, 1934.

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Commission Rulings and Schedule of Hearings

FEDERAL COMMUNICATIONS COMMISSION.
(TELEPHONE DIVISION)
WASHINGTON, D. C.

January 24: The commission set for hearing the matter of determining whether or not the Intra State Telephone Co., of Galesburg, Ill., is subject to the jurisdiction of the Federal Communications Commission. No date for the hearing was announced.

January 24: The commission set for hearing the matter of determining whether or not the Princeton Telephone Co., of Princeton, Ind., is subject to the jurisdiction of the Federal Communications Commission. No date for the hearing was announced.

ILLINOIS.

February 14: Hearing in Chicago on complaint of Avery C. Miley against the Northwestern Telephone Co., relative to changes in telephone service to complainant at his residence near Freeport, Stephenson County. The case was reopened by the commission and hearing set for this date.

LOUISIANA.

February 25: Continued hearing from January 24 in the commission's rate inquiry of the Southern Bell Telephone & Telegraph Co.

MISSISSIPPI.

February 6: Petition filed by Mississippi Hotel Owners' Association asking a reduction in telephone rates charged hotels in the state, to put the rates on a level with those of neighboring states.

MISSOURI.

January 23: Approval granted application of William Matthes of Laclede, Linn County, to purchase and Mrs. Fern Baker and Miss Gladys Baker to sell the telephone system at Breckenridge, Mooresville and Utica, and for a certificate of convenience and necessity to Mr. Matthes to operate the system.

February 7: Approval granted joint application of Troy Simpkins to sell and Ida B. Stouffer to purchase the Purdy Telephone Co., located at Purdy.

NEBRASKA.

February 4: Application dismissed of the Central Nebraska Telephone Co. for authority to change rates at its Brady and Maxwell exchanges.

February 5: Approval granted application of the Arapahoe Telephone Co. for authority to extend for a year the present reduced emergency rate schedules.

February 5: Approval granted application of the Inavale Independent Telephone Co. for authority to continue in full force and effect its rate of $9 per year for stockholders and non-stockholders, for one year.

February 5: Approval granted application of the Farmers Mutual Telephone Co., of Avoca, for authority to publish for another year net rates of 35 cents a month for farm stockholders, 50 cents for town residences and 75 cents for business service.

February 9: Approval granted application of the Ames Creek Telephone Co. for authority to continue present emergency rates at its Obert exchange for one year.

NEW YORK.

February 5: Hearing in New York in the state-wide rate investigation of the New York Telephone Co.

OHIO.

February: The Ohio Community Telephone Co., of Cadiz, has applied to the commission for authority to add to its code of rules the following explanatory provision:

"Connections of toll board schedule of rates and charges filed for telephone exchange service cover the use of circuit connections to and from (but not beyond) any toll board within the exchange area for incoming and outgoing messages in telephone toll service."

February 8: Authority granted the Portsmouth Home Telephone Co. to amend its tariff for Portsmouth and New Boston to extend its discount period from the 10th to the 12th of each month. The commission also authorized the company to add to its central rules the regulation setting forth the fact that exchange rentals in no wise cover all toll service..

The change authorized on the discount period was granted by the commission on the petition of the company received February 5 that it could meet the necessity of conforming to the pay days of the employes of the major industries of Portsmouth and New Boston.

OKLAHOMA.

February 19: Hearing on petition asking a rehearing in the Tulsa rate case of the Southwestern Bell Telephone Co.

OREGON.

January 28: Order issued by Commissioner C. M. Thomas reaffirming his previous decision reducing the rates of the Pacific Telephone & Telegraph Co. estimated to save subscribers approximately $360,000 annually.

WISCONSIN.

January 30: Emergency rate reductions ordered extended by the following companies: Lima Telephone Co., Sheboygan Falls; Rubicon Telephone Co., Hartford; Norwalk Independent Telephone Co.; Perry Hollandale Telephone Co.; Pigeon Valley Farmers Telephone Co., Pigeon Falls; and Horseshoe Telephone Co., Kewaunee.

February 5: Order issued approving a reduction of $4,250 in the rates of the Monroe County Telephone Co. at Sparta, effective February 1. Sparta's 850 customers will save $2,500 a year and the 450 farm customers of the company about $1,750 a year, the commission estimated.

February 7: Extra charges on the 50,500 handset telephones of the Wisconsin Telephone Co. now in use ordered reduced from 25 cents to eight cents per month. The order becomes effective August 5, unless temporary injunctions against the commission on three previous orders are dissolved before that time.

Answers to Traffic Questions on Page 11.

1. The "BY" call order is left with the tributary operator.

2. Say to the number called, for example: "I have a call for you. Will you accept it first, please?"

3. That depends upon what happens on the first attempt. If a "DA" report is received, for example, the call still remains a station-to-station call. If, however, the called station is reached and the charge is not accepted and the calling party will not agree to pay for the call and the call is cancelled, if the day station-to-station rate is 20 cents or more, the call is classified as a person-to-person call.

4. No.

5. Yes, if the calling party requests you to do so.

PATIENCE

By MISS ANNE BARNES

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa

Patience is just as much of a virtue today as it was in the days of our grandparents. I am glad this virtue has not been thrown into the discard by today's generation. "Can you take it?" jeers youth when some one seems ready to flare up.

Patience requires *self-mastery.* The late Theodore Roosevelt once remarked: "Free people can escape being mastered by others only by being able to master themselves."

Many people are provoked to the point of impatience when things don't move fast enough to keep up with their ideas. But we have only to look out of our windows to observe the working ways of nature. Her problems are much the same as ours, yet she solves them without sputtering or confusion over hindrances. People who have been reared on farms have come to know nature's way through long association together and so they are more likely to be patient than city folks.

Impatience is due to discouragement or inferior complex. We can overcome either of these peace and poise destroyers if we refuse to harbor them. When we feel that we are "slipping" in self-control and tolerance we would do well to reflect on the ways of nature.

Nature is tranquil, undisturbed; goes patiently about her business of growing; never gives up growing as long as life lasts—not even then. If swept down by storms, she starts rebuilding immediately with the same quiet, resistless force.

Those who live in corn-raising states may at some time have seen whole fields of corn laid low, but in a few days most of the stalks are up and back to growing again.

If there is any place on earth where it is necessary to keep one's patience *always far above par,* it is in a telephone exchange —*any* telephone exchange. When we find ourselves about to give away to impatience let us squarely face our mental being and ask ourselves this question, in youth's way: "Can you take it?"

Calls Over Seas to Ask About "73 Below"

Indicating the increasing responsiveness of old country newspaperdom to the advantages of rapid, dependable, transoceanic communication by telephone, the medical officer of health, Dr. H. Maitland Young, of Iroquois Falls, in northern Ontario, Canada, received a telephone call on January 25 from the Daily Mail of London, England.

The editor said he had received an authentic report that the temperature around Iroquois Falls was 73 degrees below zero that day. He asked the doctor to provide him with a list of "casualties." Fortunately, there were none to report and the editor was assured that even at so low a temperature in that high, dry northern climate, business was going on very much "as usual."

Editor and doctor, 4,000 miles apart, chatted for more than 15 minutes on the general topics of weather and health and the newspaperman wrote the result of the interview for his press.

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Wisconsin Locally Owned Telephone Group Meeting

The Wisconsin Locally Owned Telephone Group, of which H. A. Price, of Markesan, is secretary, has announced its annual meeting to be held at the Park Hotel in Madison jointly with the Wisconsin State Telephone Association scheduled for March 5, 6 and 7.

The entire day of March 5 will be given over exclusively to the Locally Owned Group for its program.

• • •

Recent Prices in the Metal Markets

New York City, N. Y., February 11: Copper—Quiet; electrolytic spot and future, blue eagle, 9.00 c per lb. Lead—Steady; spot New York, 3.50c per lb.; East St. Louis, 3.35c. Zinc—Dull; East St. Louis spot and future, 3.70c per lb.

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The only way the electrical energy of a DURO-POWR Telephone Battery can get out is through the terminals.

It can't get out through losses at soldered joints because the zinc cup is seamless, and it can't get out by evaporation or contamination through the top because the patented Hermetic Top Seal keeps the chemical moisture in and air out.

This means that there can be no loss in idleness—no deterioration from age, air or temperature.

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General Dry Batteries of Canada, Ltd., Toronto, Canada

Makers of all types of dependable Dry Batteries for Radio, Ignition, Flashlight and General Use.

Telephone Men Undaunted by Mountains of Snow and Zero Weather

By ALLEN P. WALCH

Late last month central Wisconsin was visited by the most severe cold wave in years with thermometers registering more than 30 degrees below zero on three successive mornings and never rising above the zero mark for more than a week. This unusually frigid atmosphere followed immediately after snow storms had blocked every highway so that car travel or even the use of horses was impossible.

As is always the case under such harsh weather conditions, there were considerably more than the customary number of trouble calls at the office of the Manawa (Wis.) Telephone Co.

Farmer lines were experiencing the most difficulty and, together with the lack of trunk line service between neighboring towns, the patience of more than one patron was becoming frayed to the point where trouble-shooters were getting much more than their share of criticism. No one really appreciates a telephone until he has to do without it.

Finally Arnold Sears (or "Bud" as he is better known) volunteered to take a chance on re-establishing telephone service between Manawa and its nearest neighbor on the west, a town called Ogdensburg, six miles away. Lineman Sears took the morning train to that village, accompanied only by his tool kit and a pair of snow shoes.

He used the shoes on the long trek home and, while on the trip back to Manawa through and over a hundred 10-foot snow banks, he located and remedied the trouble that had disrupted service between the towns for three days.

On another occasion, Albert Drath, who had been without a telephone for several years, wanted an instrument installed at his farm home several miles northwest of Manawa. His rather sudden request was occasioned by the fact that he was forced to make his headquarters in Manawa for several days while the snow and cold were at their worst. He drove a truck for a nearby milk factory but, because of the drifted roads, he was unable to make deliveries.

As his home is located nearly two miles from the main highway which was plowed out the third day after the storm, Mr. Drath expressed his wish for a telephone but opined that he "guessed he'd have to wait until all the roads were plowed out."

He was anxious about his family, however, and when L. M. Lamkins, manager of the Manawa Telephone Co., heard about the man's predicament, he again enlisted the services of "Bud" Sears and, together, they accomplished what Mr. Drath thought impossible.

They trucked the equipment as far as possible on the main highway, and then took to snow shoes to haul it to the Drath home, a distance of two more miles through drifts and crusted snow, breaking their own trail all the way.

They installed the telephone, and when the truck driver returned to Manawa at six o'clock that evening after he had made his first short trip in nearly a week, he was able to carry on a conversation with his family over the newly-installed telephone. And it was only a day after he had expressed his wish for some means of communication with home.

• • •

Mrs. L. M. Berry of Dayton, Ohio, Dead

The many friends of L. M. Berry, president of L. M. Berry & Co., Dayton, Ohio, will be saddened to learn of the death of Mrs. Berry at their home on February 9. Mrs. Berry had not been in good health for about a year and for the past four months had been confined to her home by a heart ailment.

She was the daughter of Mr. and Mrs. John E. Kneipple and was born in Indiana but had lived in Dayton for many years. She was active in social and civic organizations in her home community, but was primarily a home woman much interested in her family.

In addition to Mr. Berry, she is survived by two daughters and two sons, one of whom is a student at Northwestern University in Chicago. Another son passed away about a year ago following a mastoid operation.

Pennsylvania Convention Set for May 14 and 15

The Pennsylvania State Telephone & Traffic Association will hold its annual convention at the Penn-Harris Hotel in Harrisburg on Tuesday and Wednesday, May 14 and 15, according to recent information received from President H. E. Bradley, of Harrisburg.

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Telephone and Telegraph Wire

• • •

Steel Strand

Modern Toll Switchboards and Toll Switching Equipment

By R. C. ARTER
Chief Engineer, North Electric Mfg. Co., Galion, Ohio

USE OF switching equipment for the establishing of toll connections in areas served primarily by dial exchanges. Description of handling traffic by modern type of toll switchboards in Northern Ohio Exchanges

VERY LITTLE PUBLICITY has been given to the modern types of toll switching equipment in use by Independent operating telephone companies. The introduction of modern switching equipment for toll service in Ohio began in the year 1922 with the installation of an all-relay switchboard for the Northern Ohio Telephone Co. at Galion, Ohio. At the present time there are nine of these all-relay automatic type switchboards in service, of various sizes, ranging from two positions up to 12 positions equipped.

For many years little progress had been made in the development of toll boards and even today most of the toll boards in service are exactly as they were built 25 or 30 years ago. The primitive magneto type switchboard with the simple magneto cord circuit, provided with the usual ringing and listening keys, had been considered as the ultimate arrangement for handling toll connections.

The general use of the combined line and recording (CLR) method of handling calls, the use of amplifiers, the demand of the public for more rapid toll connections and the increase in the use of toll by subscribers, where more rapid and better toll communication is available, created a demand for a better system of establishing toll connections. A result of this demand was the production of an all-relay toll switchboard by North Electric Mfg. Co.

At first thought, it did appear that little was to be gained by the introduction of the switching equipment into the establishing of toll connections. However, the reverse is true, the advantages being many.

The use of relay equipment for effecting the connections results in a quicker completion of the calls with less physical and mental fatigue to the operators, and an average increase of about 35 per cent in the amount of connections handled per operator hour. A very material reduction in the cost of switchboard maintenance and repairs is also realized.

These later type switchboards also increase the scope of the toll operator, permitting her to handle the complete toll service for several exchanges. This type equipment is almost a necessity in areas that are converted to automatic

Some Interesting Examples of Modern Toll Equipment. To the Left is the Latest Type of All-Relay Toll Switchboard, Located at Mansfield, Ohio, and Furnishing Outward Toll Service for Six Exchange Areas. The Switchboard Shown in the Other Illustration is Located at Marysville, Ohio, and Serves Four Exchange Areas.

The voltage across the east network sets up a circulating current which is dissipated in the network, while the voltage set up across the line output winding causes current to flow to the distant terminal.

Under the condition where the network balances the line impedance, the west-to-east voice currents in passing through the amplifier encounter a total loss of 6.0 db plus coil loss (disregarding the amplifier gain) or approximately 7.0 db. It will be seen that this is the same loss that voice currents suffer in passing through a 21 type repeater.

Like the 21 type repeater, the amplifying element must, therefore, contribute 7.0 db plus the desired insertion gain. For example, if the amplifying element were set to give a

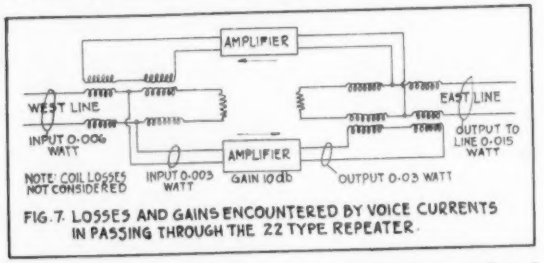

FIG. 7. LOSSES AND GAINS ENCOUNTERED BY VOICE CURRENTS IN PASSING THROUGH THE 22 TYPE REPEATER.

gain of 17 db, the actual gain or amplification contributed by a repeater to voice currents passing through it would be only 10 db.

The operation of the 22 type repeater in the east-west direction is identical with the operation as just explained.

Fig. 7 illustrates the various losses and gains which the voice currents encounter in passing through a repeater.

The artificial network generally consists of a resistance and capacity in series. If telegraph, carrier, or other similar apparatus is superimposed on a voice-frequency repeatered telephone circuit, the impedance equivalent of these items must be provided in the network, if the line impedance is to be accurately balanced.

Fig. 8 shows a typical 22 type repeater simplified schematic. It will be seen that only a single vacuum tube is used for each of the amplifying units. The gain of the amplifier is controlled by means of an input potentiometer as shown. The filter shown is a necessary part of a repeater circuit and is designed to cut off frequencies outside of the useful telephone voice range (about 3,000 cycles). This simplifies the problem of balancing the network impedance of the line against the line impedance.

The filaments of the vacuum tubes in common use in repeater work or supplied with direct current from the 24-volt central office battery, while plate potential is obtained from a 120-volt storage battery, generally referred to as the repeater battery.

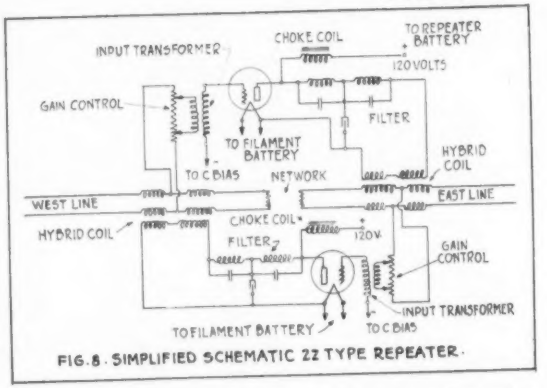

FIG. 8. SIMPLIFIED SCHEMATIC 22 TYPE REPEATER.

Appropriate filter circuits are used to prevent repeaters from cross-talking in the plate or filament supply batteries. The repeaters are mounted in bays as shown in Fig. 9.

44 Type Repeaters

Another basic type of repeater is that known as the four-wire repeater, or 44 type.

The 44 type repeater differs from the 21 and 22 types in that it is a one-way repeater. The repeater proper is merely a one-way vacuum tube amplifier. It may be used either for amplification on strictly one-way circuits, such as the radio program circuits that carry the network programs, or as a one-way amplifier in one side of a four-wire, two-way telephone circuit.

FIG. 9. A REPEATER BAY.

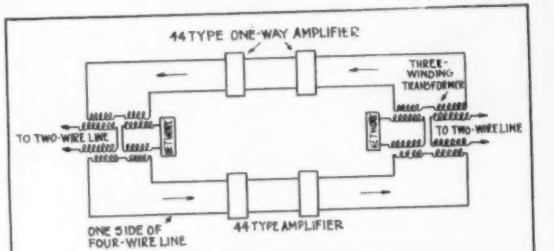

FIG 10. FOUR-WIRE - 44 TYPE REPEATER ARRANGEMENT.

The four-wire long distance circuit utilizes a separate pair of wires for transmitting in the two directions. Inasmuch as each pair of wires carries only one-way voice currents, it is feasible to use one-way vacuum tube amplifiers in these circuits.

It is, of course, necessary to convert the four-wire circuit into a two-wire circuit at the terminals of the long distance line, and this is accomplished by a typical three-winding transformer operating in the same manner as described for the 22 type repeater.

Fig. 10 illustrates schematically how a 44 type repeater and the terminating ends are arranged. The repeater amplifying circuit for the four-wire repeater is very similar to that of the two-wire type, the principal difference being in the use of two tubes instead of one in order to give greater amplification.

The four-wire type of toll circuit is useful mainly on exceptionally long-haul circuits and particularly cable circuits. The principal advantage of the 44 type repeater and a four-wire circuit is the greater gain that can be introduced at repeater points due to the elimination of the need for balancing the line in both directions against networks, as is the case with the 22 type.

Repeater Use

There are three general classes of telephone repeaters: (1) Terminal repeaters: (2) through line repeaters, (3) cord circuit repeaters. Terminal repeaters are connected at the ends of a line.

A "through line" repeater is one connected in a long distance circuit at some point between the two terminals of the circuit. "Cord circuit" repeaters are those which are terminated on switchboard cords and which may be connected between any two toll lines that have been equipped for their use. A single cord circuit repeater may thus be used to provide amplification on different circuit connections.

Of the three repeater arrangements, the terminal and through line are the most generally used. The cord circuit repeater is but little used at the present time although quite popular some years ago.

local operation, if maximum results are to be obtained.

The northern district of Ohio is rapidly becoming completely automatic for both city and rural telephones and the tendency is toward the concentration of the toll traffic at one or two points in each county. For example, the all-relay toll switchboards in service are handling exchanges as follows: Celina, four exchanges; Sidney, two exchanges; Wapakoneta, two exchanges; Marysville, four exchanges; Galion, two exchanges; Napoleon, five exchanges; Wauseon, three exchanges; Mansfield, six exchanges; Lima, five exchanges.

The subscribers in any of these automatic or automanual exchange areas calling for long distance connections are routed instantly to these all-relay toll boards, where they may be connected to any other automatic area without the intervention of another operator, or they may be connected to the long lines systems instantly by the depression of selection buttons, similar to the buttons on an adding machine.

The conversations do not pass through the toll boards; the actual switching connections are made in the switchroom, the equipment in the control board proper being only for listening and supervising purposes. The selection of idle toll lines, when not directly made by the operation of the subscriber's dial, is performed instantly by the toll operator without any stepping equipment.

When the toll connection is to pass through intermediate automatic exchanges the toll operator depresses the number on the keyset, which causes the selection of the wanted toll line at the distant automatic exchange. Owing to the various types of automatic apparatus encountered and the large network of lines offering the choice of many routes, in some cases dials are used for completing the connections in or through the distant exchanges.

Toll Switching in Distant Offices in Ohio

In many instances the switching of these toll connections in the distant offices is accomplished by the use of alternating current impulses, which pass over the toll lines following the voice current routes. By this system of operation, existing phantom groups and physical lines are used without change. No thump-absorbing equipment is required.

The largest of these all-relay automatic type toll boards is in service at Lima, Ohio. It serves five exchange areas including about 13,000 stations and establishes connections to 120 toll lines. The board is divided in two classifications: four positions for inward and through traffic, and eight outward or line positions for outgoing traffic.

The latest type of these modern toll boards is in service at Mansfield, Ohio, having been completed in November, 1934. This switchboard serves six exchange areas and approximately 12,000 stations. The operators at this switchboard handle only the outward traffic, the inward and through connections being under control of the toll operators at the originating offices, outside of the exchange areas of the Mansfield Telephone Co.

The directory of this company lists 64 cities and towns that are called by number. The subscriber's call to any of these cities appear on one of the CLR trunks assigned to that city, and the operator responds with the name of the city called. The ticket is recorded and this operator completes the connection if the wanted city is automatic, or with the aid of the local operator if the city is manual operation.

When the circuits to the wanted city are all engaged, the call arrives before the operator on overflow trunks where it may be held, or released for recall. The immediate response of the operator with the name of the wanted town, and the almost instantaneous ringing tone and response of the wanted party, are very satisfactory to the public.

Calls destined for the long line companies' circuits are instantly connected by the depressing of a single button.

The smaller sizes of the all-relay toll boards are usually arranged for handling all classes of traffic on all positions, and as much of the inward and through traffic shunted away from the toll operators as is possible. This procedure results in faster service and reduces the cost of handling the toll traffic.

In some instances; for local reasons, the outgoing traffic is shunted around the toll board, and the operator in the distant exchange records the ticket and completes the connection.

Identity Lamps on Board

The operators are able to identify established connections, by means of identity lamps that light when the link key is operated. The supervisory signals associated with the connecting links indicate the class of connection established so that operator's attention is given only to the calls in which she is interested. Either end individually or both ends of the connection may be released instantly by the depression of a single button.

The switchboard cabinets for these switchboards may be of the iron-leg, school-desk type or the usual switchboard types with very low turrets. The cabinets contain only the keyshelf and turret apparatus; no switching equipment is housed in the operators' desks.

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A. M. Haubrich, Chicago Manager For Stromberg-Carlson

The Stromberg-Carlson Telephone Mfg. Co., of Rochester, N. Y., has announced the appointment of A. M. Haubrich to the position of manager of the Chicago sales division of the company. Mr. Haubrich assumes the position left vacant by the recent death of Carl W. Schafer. H. T. McCaig will continue in the position of assistant manager.

Mr. Haubrich entered the employ of the Stromberg-Carlson company as engineer in July, 1901, after six years' intensive experience in the telephone and communications field. After a considerable period of time in this position, he was transferred to the estimating and sales engineering department, preparing the estimates and multiple specifications.

Soon after the Stromberg-Carlson factory was moved to Rochester, Mr. Haubrich was transferred there and assigned the duties of sales engineer. When Mr. Stromberg and C. W. Stiger left the company, he was transferred back to the Chicago office, becoming Chicago manager in December, 1906.

At that time, the Chicago territory extended to the Rocky Mountains on the west, the Gulf of Mexico on the south, and also included the western part of Canada. A huge stock of telephones, construction materials and telephone cables, both switchboard type and leaded paper cables, was consequently carried to meet the requirements of this extensive territory. During the World War, Mr. Haubrich was a member of the standardization committee.

In the fall of 1920, Mr. Haubrich was transferred to the export department of Stromberg-Carlson to cover South America. On January 1, 1921, he started for Rio de Janeiro and covered practically all of the South American countries in a period of ten years. Most of his time there was spent in Colombia, which was passing through a period of modernization in all lines. On his return from South America, he was granted a leave of absence by the company to devote his time to study and research in the telephone field.

A great many improvements and innovations in telephone communication are attributed to Mr. Haubrich.

In commenting upon his appointment, Mr. Haubrich said: "I am most happy to get back in the harness again as the acting Chicago manager and will take great pleasure in serving the old patrons and the new patrons, who in many cases are the sons of the pioneers in the telephone field, which shows the permanency in the art of communication. It is with great regret that I will have to 'carry on' without the aid of my old associate, Carl W. Schafer."

J. K. Johnston
TELEPHONE ENGINEER
Appraisals, Rate Surveys,
More than 750 companies have been served.
1038-9 Lemcke Bldg. Indianapolis

Frank F. Fowle & Co.
Electrical and Mechanical
ENGINEERS
221 North La Salle St. CHICAGO

ACCOUNTING
HERDRICH AND BOGGS
Certified Public Accountants
Specializing in Telephone Accounting
and Rate Cases Since 1918
901-7 Continental Bank Bldg.
Indianapolis, Indiana

COFFEY SYSTEM
Exclusive Telephone Accountants
CERTIFIED
Systems Installed
Audits and Special Services
CENTRAL ACCOUNTING DEPARTMENT
Consolidated Bldg., Indianapolis

Consulting Telephone Engineer
"Modernization of Equipment and Methods for Improved Service"
GARRISON BABCOCK
1104 Third Avenue, Seattle, Washington

Brief Telephone News

Franchises

HOLYROOD, KANS.—The Holyrood Telephone Co. has been granted a franchise extension for another 20 years, by the city council.

Financial

NEW HAVEN, CONN.—Net income of the Southern New England Telephone Co. for the year ended December 31 was $2,315,826, against $2,404,406 in 1933.

Construction

SAN BERNARDINO, CALIF.—Permission to erect telephone lines in three districts has been granted to the United States Forest Service by the board of supervisors. The forest service is reconstructing its entire telephone system, which will have its headquarters in the future at Del Rosa.

Permission to erect a line from Irvington to Devil canyon; from a point north of Fifty-fourth street to the Pacific Electric tracks north of San Bernardino and along Sterling avenue between Foothill street and the Santa Fe tracks, between Del Rosa and Highland, was given by the board at the request of Assistant Supervisor Frank A. Robinson.

NEW HAVEN, CONN.—The Southern New England Telephone Co. has prepared a budget for 1935 construction anticipating outlays totaling $4,800,000 in plant development and improvement. The gross additions will be about $2,250,000. Outside plant expenditures will total $1,140,000, of which $85,000 will be for toll lines and the balance for exchange lines. About 97 per cent of the company wires are now in cable.

For land and buildings $275,000 has been allocated, including about $100,000 for a new exchange at West Hartford. Both local and toll service is expected to increase over 1934, when 5,156 net stations were added.

Elections

GENESEO, ILL.—The subscribers of the East Munson Telephone Co. met at the Dublin school house for their annual meeting, Friday evening, January 18, and the following officers were elected: President, Guy C. Ole; secretary, J. W. Terpening; director for three years, Ross Sturm; director for two years, Frank De Smith. The third director is Frank Sundeen.

Miss Ida Nitz, chief operator for the Geneseo Co-operative Telephone Co., was present and in a short talk told of the operation of the central switchboard, and the services the company has for use of rural telephone users.

Plans were made for moving the lines along route 7, and an assessment was levied to meet the company's share of that expense.

(*Concluded on page* 34)

Buyer's Weekly Guide

A list of firms and companies offering equipment, supplies or services for operating telephone companies

ADDING MACHINES

Burroughs Adding Machine Company, Second Blvd., Detroit, Mich. — Adding, Bookkeeping, Calculating, Billing and Accounting Machines, Electric Carriage Typewriters, Standard Typewriters, Operator Correct-Posture Chairs. Burroughs machines are in use today in hundreds of progressive telephone companies throughout the country.

BATTERIES—DRY CELLS

Bond Electric Corporation, 257 Cornelison Ave., Jersey City, N. J.—Bond Telephone Dry Cells, Bond Flashlights and Batteries, Industrial Flashlights and Batteries, Bond Dry Batteries, Storage Batteries, Voltpruf Special Flashlights for linemen. Victor Telephone Cells and Bond Formula 1216 Inhibitor, ideal for keeping the cooling system of trucks and service cars free from rust, scale and corrosion.

National Carbon Company, 30 E. 42nd St., New York.—"Columbia" Telephone Dry Batteries; "Eveready" Flashlights, Flashlight Batteries and Long Life Dry Cells, "National Pyramid" brushes, carbon, graphite and metal graphite for motors, generators and rotary converters. "Eveready" Prestone anti-freeze; "Eveready" Rustone rust preventive; and "Eveready" Air Cell telephone operators' transmitter batteries.

Ray-O-Vac Company, Madison, Wis.—Ray-O-Vac telephone batteries — longer life and better service proven by tests in accordance with U. S. Government standards and records of users. Ray-O-Vac flashlights and industrial flashlight batteries are other items showing Ray-O-Vac's outstanding quality.

BATTERIES—STORAGE

The Electric Storage Battery Company, Allegheny Ave. and 19th St., Philadelphia, Pa.—Exide Storage Batteries. Branches: Boston, New York, Rochester, Philadelphia, Pittsburgh, Washington, Atlanta, Cincinnati, Cleveland, Detroit, Chicago, Kansas City, Minneapolis, St. Louis, Denver, San Francisco and Seattle.

BATTERY CHARGING EQUIPMENT

General Electric Company, Bridgeport, Conn.—Tungar battery chargers. G-E pole line hardware. Cable filling compound.

CABLE—LEAD ENCASED

American Electrical Works, Phillipsdale, R. I.—Paper telephone cable, switchboard cable, bare copper cable. Chicago Office: 112 W. Adams St.; Cincinnati: Traction Bldg.; New York: 100 E. 42nd St.

British Insulated Cables, Ltd., Surrey House, Embankment, W. C. 2, Factory: Prescot, Lancashire, England.—Telephone cable of all sizes and capacities.

General Cable Corporation, 420 Lexington Ave., New York, N. Y.—Paper telephone cables of standardized manufacture for over forty years. Weatherproof and insulated copperweld drop wire.

Eugene F. Phillips Electrical Works, Ltd., Montreal, Can.—For any type of wire or cable used in telephone, telegraph or power work get in touch with "Phillips." Manufacturers of bare and insulated copper wires, rubber insulated wires, enameled wire, magnet wire, telephone cables, power cables, switchboard cables, flexible cords, copper rods, etc.

CABLE RINGS

National Telephone Supply Company, 5100 Superior Ave., Cleveland, Ohio.—National Cable Rings, National Splicing Sleeves, Non-Breakable Messenger Cable Hangers, Marlin and Swisher Cable Hangers and Custom Galvanizers. National cable rings are practical because they are two-way,—they allow the cable to be pulled in either direction. National sleeves make secure the weakest points in the line. If it's a splice—make it a National.

CABLE TERMINALS

Cook Electric Company, 2700 Southport Ave., Chicago, Ill.—Protective Pole Cable Terminals, Unprotected Pole Cable Terminals, central office protection, lightning arresters, sleeves, fuses.

Reliable Electric Company, 3145 Carroll Ave., Chicago, Ill.—A complete line of telephone and switchboard protectors and specialties. All sizes of cable grips.

CARBON DIAPHRAGMS

Noris Carbon Company, Inc., 160 5th Ave., New York, N. Y.—Carbon diaphragms, carbon back plates, granular and globular carbons, lightning arresters.

CONDUIT

Brazil Hollow Brick & Tile Company, Brazil, Ind.—Makers of Brazil Vitrified Tile. Conduit.

CORDS, CABLE AND WIRE

Lenz Electric Manufacturing Co., 1751 N. Western Ave., Chicago—Established 1904—telephone and switchboard cords for all makes of equipment, braided and lead-covered telephone cable, flame-proof jumper wire, interior telephone wire, switchboard wire.

CORDS AND WIRE

Runzel Cord & Wire Co., 4727-31 Montrose Ave., Chicago—Telephone and Switchboard Cords, Flame-proof Jumper Wire, Switchboard Wire, Interior Telephone Wire. W. L. Runzel, President, has devoted over 40 years to the making of fine telephone cords.

ELAPSED TIME RECORDERS

Calculagraph Company, 50 Church St., New York, N. Y.—Calculagraph is the world's standard elapsed time recorder and gives you toll records printed with elapsed time to the second. Both spring driven and electric motor models are available.

POLES

B. J. Carney & Co., 100 N. 7th St., Minneapolis, Minn.—Western red cedar poles. Pentrex Butt Treated or Plain.

Alfred E. Cowling, Scotstown, Quebec.—Eastern cedar poles, plain or butt treated.

MacGillis & Gibbs Company, Milwaukee, Wis.—Northern White and Western Red Cedar Poles. Plain or butt-treated. Immediate quotations on request.

Michigan Pole & Tie Company, Newberry and Grand Rapids, Mich. — "Poles with Character." Northern White and Western Red Cedar. Strategically located yards, Minneapolis, Minn., and Reed City (Lower Michigan), insure quick deliveries.

H. Sigalet & Company, Ltd., Lumby, B. C., Canada — Western Red Cedar Poles. Plain or Butt treated.

Valentine Clark Corporation, 2516 Doswell Ave., St. Paul, Minn.—Finished Cedar Poles. Plain or Butt treated.

SUPPLIES, SWITCHBOARDS AND INSTRUMENTS

Automatic Electric Company, 1033 W. Van Buren St., Chicago, Ill.—Public Automatic Dial Systems, Private Automatic Dial Systems, Telephones, relays, signaling and control equipment.

Automatic Electric Company, Ltd., Milton Road, Edge Lane, Liverpool, England.—Automatic Telephone Equipment.

Automatic Electric Sales Company, Ltd., 1027 W. Van Buren St., Chicago, Ill.—Public Automatic Dial Systems, Private Automatic Dial Systems, Manual Telephone Equipment, telephones, storage batteries, wire, cable, poles, etc.

Kellogg Switchboard & Supply Company, Adams & Aberdeen Sts., Chicago, Ill.—Engineers and designers, manufacturers and suppliers of complete equipment for telephone exchanges and communication systems. Manufacturers of "Master-built" Common Battery, Magneto and PBX Switchboards, "Masterphone" Telephone Instruments, and a complete line of telephone supplies, including bronze drop and interior wire.

North Electric Manufacturing Company, Galion, Ohio—Machine switching telephone systems. Automanual and Automatic. "All-Relay" Switching Apparatus (Dialless and Dial Control). Unattended Satellite Systems.

Siemens Brothers & Company, Ltd., Woolwich, England—Automatic and Manual Telephone Equipment.

Stromberg-Carlson Telephone Manufacturing Company, 100 Carlson Road, Rochester, N. Y. — Telephone apparatus of all kinds, switchboard cords, cable and general telephone supplies.

TOOLS

Crescent Tool Co., Jamestown, N. Y.—CRESTOLOY Pliers, Curved Needle Nose Pliers, Heavy Diagonal Cutting Pliers, Linemen's Side Cutting Pliers, End Cutting Nippers, Crescent Hack Saws.

TRANSMITTER REPAIRS

The Telephone Repair Shop, 1760 Lunt Ave., Chicago, Ill.—Transmitters completely rebuilt and arranged for either magneto or C. B. service. Transmitter fronts and backs refinished in black. Transmitter buttons cleaned and refilled. Receivers repaired; ringer coils and generator armatures rewound.

CLASSIFIED SECTION

Rates 10 cents per word payable in advance. Minimum charge $2.00 for 20 words or less.

RECONSTRUCTED EQUIPMENT

Model No. 6 Style C Flush type Spring Driven Calculagraph, Rebuilt and Refinished complete with New Ribbon @	$26.50
Pedestal type Spring driven Calculagraphs, complete as above @	36.50
Western Elec. No. 20 desk set with W. E. Trans. & Rec. complete with No. 240 3-bar 1000-1600 or 2500 ohm external post connection signal set @	3.35
Double pole, double throw 15 Amp. Knife switches @	.15
Kellogg No. 118 desk set with Kellogg Trans & Rec. complete with W. E. No. 240 3-bar 1000-1600 or 2500 ohm external post connection signal set @	3.35
Automatic Elec. slip type Receiver with repolished shell & New Cord @	1.00
Leich Elec. Latest type slip type Receiver with New shell & cord @	1.15
Kellogg No. 22 or Western Elec. No. 329 Transmitter complete with back & New mouthpieces @	1.10

REBUILT ELECTRIC EQUIPMENT CO.
Not Inc.
1940 W. 21st St., Pilsen Station
Chicago, Ill.

FOR SALE
Refinished practically new, late-type, push-in, folding door telephone booths as low as $16.00 in lots of 6. Single booth prices on request; also 5,000—1¼"x8". Rock Elm Insulator pins, $13.00 per 1,000. Prices F.O.B. Chicago.
W. M. MILLER & SONS
2553 W. Madison St. Chicago, Ill.

RINGING MACHINES

Holtzer Cabot Type

Motor 110-volt, 60-cycle A. C. Generator 80 volts, 19-cycle A. C.

$45.00

Motor 115-volt D. C. Generator 80 volts, 19-cycle A. C.

$40.00

First-Class Condition.

Guaranteed.

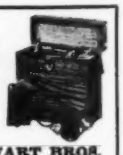
BUCKEYE TELEPHONE AND SUPPLY CO.

COLUMBUS, OHIO

FOR SALE

CABLE TESTER

With balanced coil. Locates shorts, crosses, grounds and wet spots; also tone circuit.



$49.00 **Sent on trial.**

STEWART BROS.
Ottawa, Ill.

FOR SALE—Telephone Exchange; New Cable Plant, exchange in good condition. 250 Subscribers, can be built up to 350; good farming community, 20 miles from Springfield, Missouri. Priced right for quick sale. Address, B-45, in care of

---

FOR SALE—Magneto telephone system in Missouri. 500 subscribers. Gross revenue $10,000.00 per year. Company incorporated. Correspondence solicited. No trades. Box 8415, care of TELEPHONY.

TELEPHONE MANAGERS HERE'S JUST WHAT YOU HAVE BEEN LOOKING FOR

Send $2.00 and we will mail you at once the Handy Advertising Kit. Contains 50 brand new advertising and sales ideas, each one has been carefully selected and tested and will produce results. Mail your check today to The Telephone Advertising Company, 1315 P Street, Lincoln, Nebraska.

POSITION WANTED

PUBLIC RELATIONS COUNSELLOR available for temporary work with utility companies, state commissions, or communities; 35 years of service with very broad experience in every angle of public relations work. Telephone and telegraph working experience, followed by 21 years as director of telephone-telegraph utilities with the Massachusetts Department of Public Utilities; many years' lecture work on public relations; former member of legislature; active in labor circles. References furnished on request. Address William H. O'Brien, 15 Bowditch Road, Jamaica Plain, Boston, Mass., or editor of TELEPHONY.

SITUATION WANTED—Commercial or traffic manager, fifteen years' experience. Can furnish the best of references as to my ability, etc. Address 8323, care of TELEPHONY.

WANTED TO BUY

TELEPHONE PLANT will buy, lease with option to buy, 100 to 500 stations at once. Address 8414, care TELEPHONY.

(Concluded from page 32)

Telephones Gained

NEW HAVEN, CONN.—The Southern New England Telephone Co. reports a net gain of 5,156 stations during 1934, bringing the total at the close of the year up to 294,083. This compares with the high total of 329,137 stations at the close of October, 1930.

NEW YORK, N. Y.—The Bell System recorded a gain of 30,100 telephones in service on its lines in January, against an increase of 22,500 in the same month last year and a net loss of 121,000 in the first month of 1933. There was a gain of 21,200 stations in December, 1934.

NEW YORK, N. Y.—The New York Telephone Co. has reported a January station loss of 487, compared with a gain of 89 in January, 1934, and a loss of 18,329 in January, 1933.

COLUMBUS, OHIO.—The Ohio Bell Telephone Co. during the month of January made 1,025 connections in Columbus as against 858 telephones disconnected, making a net gain of 167 telephones for the month, which was the highest January increase since 1929. The number of connections made in January of 1933 was 823 telephones, and 902 in the same month of 1934.

The net increase in the number of telephones in January for the past five years shows 157 in 1930, 222 decrease in 1931, 496 decrease in 1932, 486 decrease in 1933, and an increase of 130 in 1934.

APPLETON, WIS.—Telephones in the local exchange of the Wisconsin Telephone Co. increased 129 during 1934 as compared with a loss of 151 in 1933.

At present the Appleton exchange serves 8,147 telephones. During December, patrons used their telephones for local calls on an average of 52,957 times daily. Long distance telephone calls completed averaged 752 each day.

A betterment in telephone business also has been felt throughout the Appleton district area of the company, which includes 31 communities in the northeastern part of the state. During the year there was a net gain of 986 telephones throughout the district, it was stated by F. N. Belanger, district manager. In 1933 the district reported a loss of 2,495 telephones.

This improvement also has been noticed throughout the state. Total telephones served by the company increased 6,843 during the year as compared with a loss of 15,528 telephones in 1933.

Obituary

DE QUEEN, ARK.—John A. Wommack, 73, owner of the De Queen Telephone Co. here, was found dead in bed recently, apparently from a stroke. He had been in ill health for several months. He organized the De Queen Telephone Co. in 1900. An ex-mayor, he had held many city offices.

NEW HAVEN, CONN.—Hermann Kraft, assistant to the general auditor of the Southern New England Telephone Co. here, and for nearly 50 years in the company's service, passed away recently at his home in New Haven, following a heart attack.

BIDDEFORD, ME.—Frank S. Goodwin, formerly manager of the local exchange area for the New England Telephone & Telegraph Co., died recently at his home here. He entered the service in 1897 and was manager from 1905 to his retirement in 1926.